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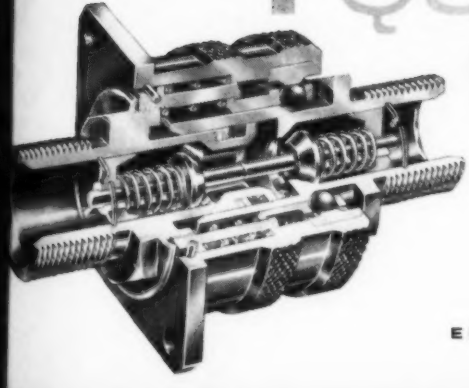

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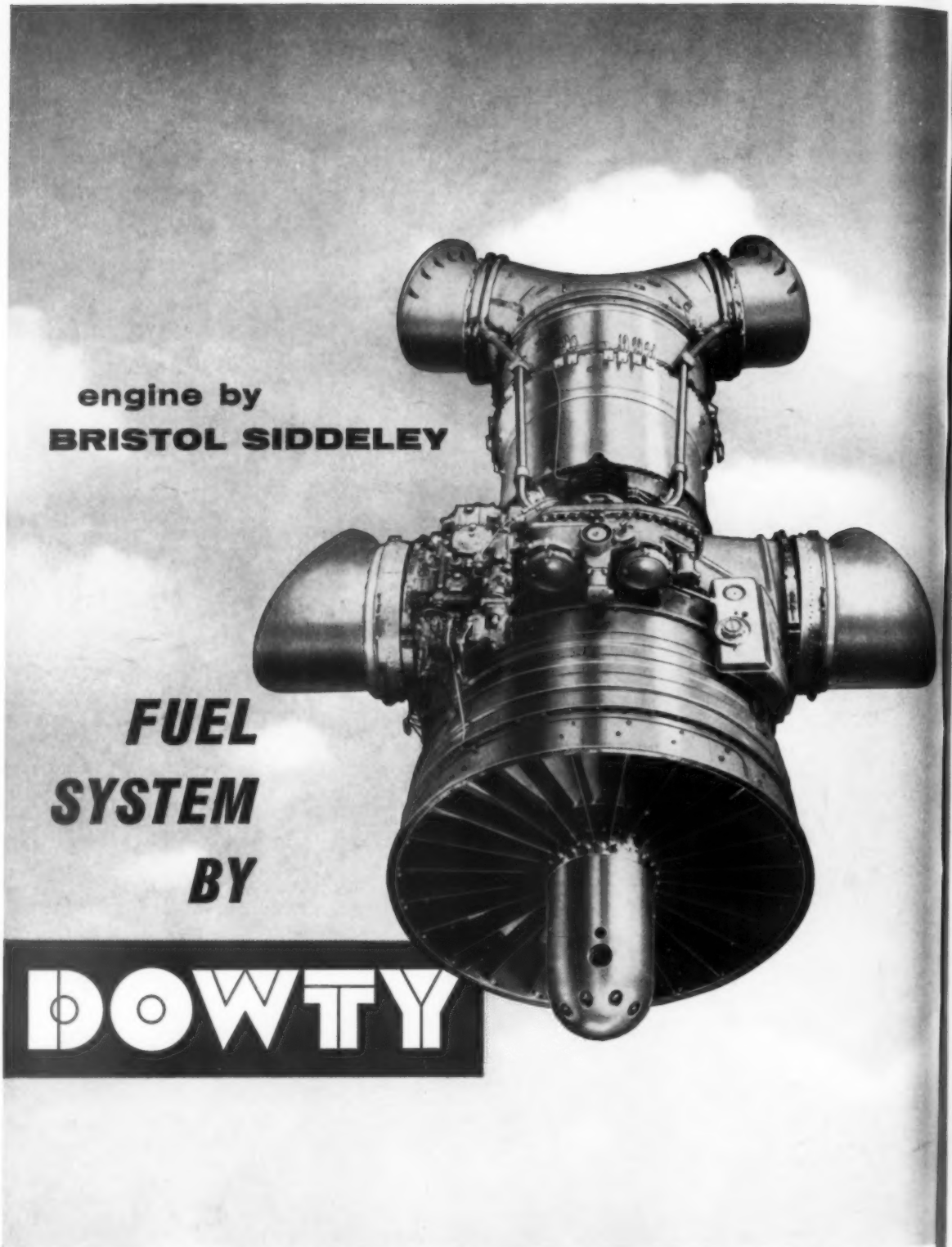

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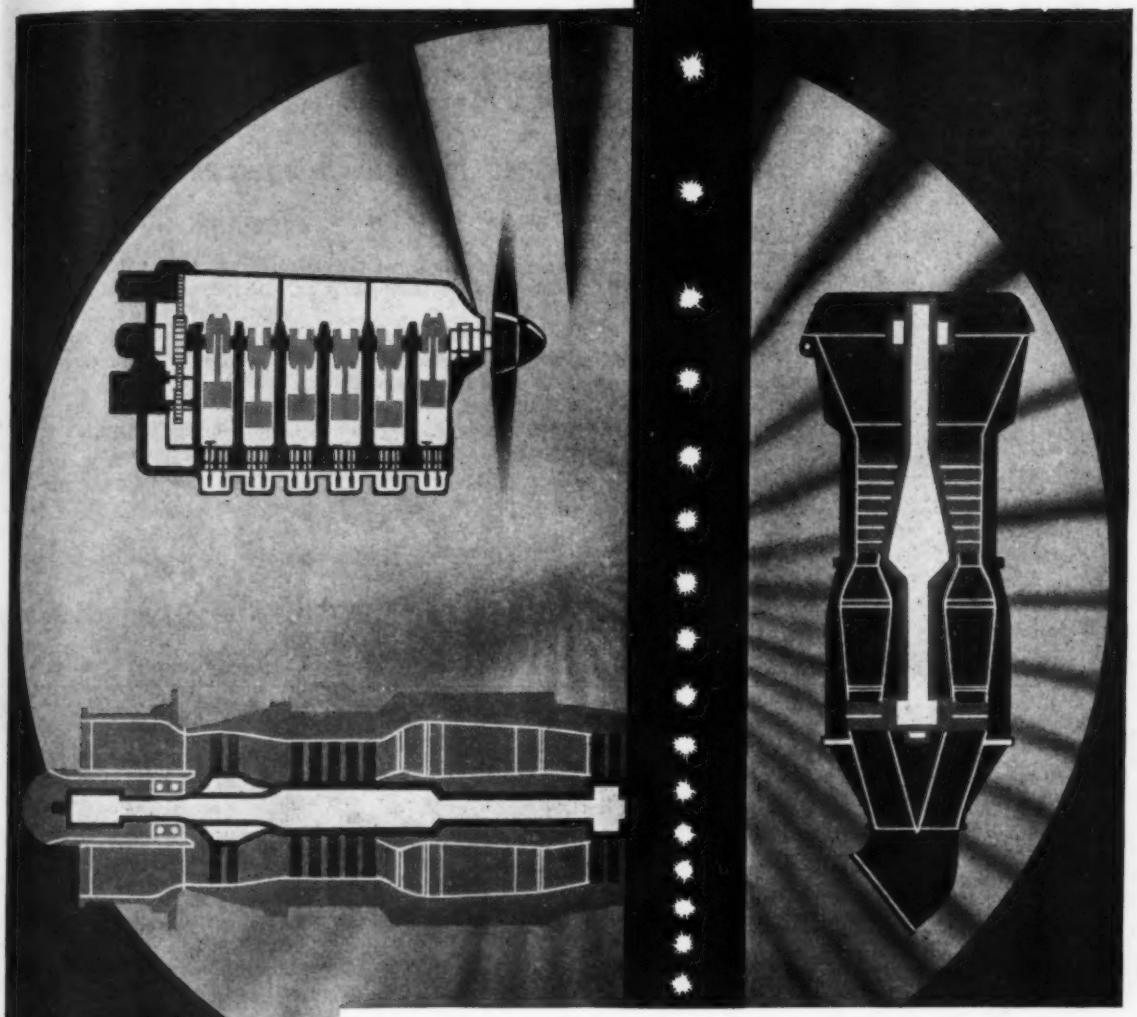

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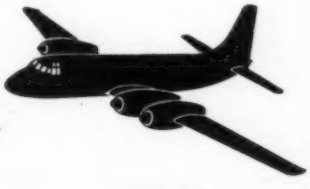

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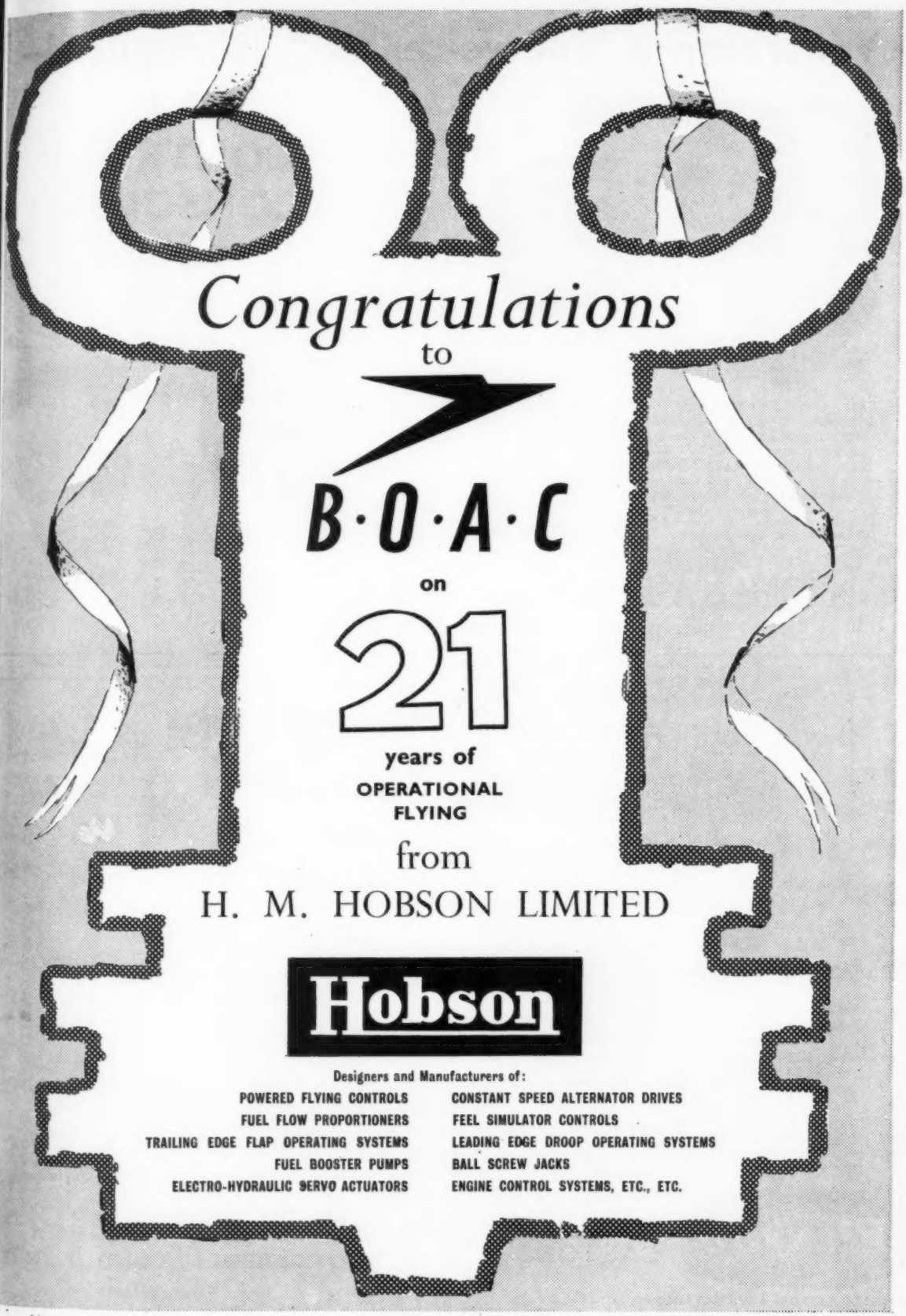

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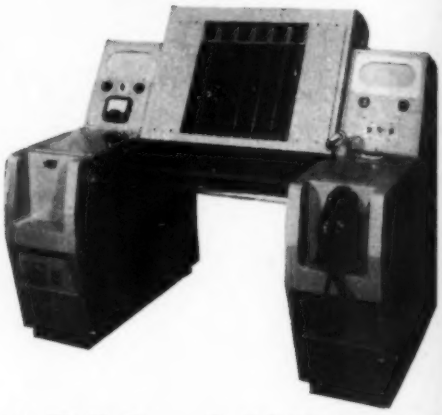

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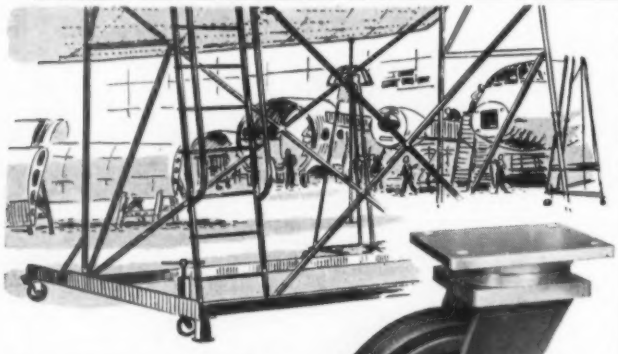

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No 2716 VOLUME 79 THURSDAY 30 MARCH 1961

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Safety and Secrecy

AN air accident is defined in the Civil Aviation Regulations as "any fortuitous or unexpected event by which the safety of an aircraft or any person is threatened"—though there is no need to consult a law book for confirmation that last month's near miss in the London Control Zone was an accident. It will be recalled that on February 21 a Trans-Canada Air Lines DC-8, after taking off from runway 10L, passed within "a few hundred feet" of a United Arab Airlines Comet 4C, whose commander promptly filed a violation report. An investigation was immediately undertaken by the Ministry of Aviation.

Repeated requests during the past six weeks for information about the findings of this investigation—which must surely have been completed by now—have been answered by an evasive "It is not normally the practice to disclose the findings of this type of investigation." So, as in the case of at least thirty-nine other accidents investigated by the Ministry during the past ten years, the findings are to remain secret.

In the opinion of the Cairns Committee, which last December reported on the UK system of civil aircraft accident investigation, a near miss in controlled air space "may be only marginally removed from a major tragedy; and because the crews involved are both available to say what happened, the lessons to be learned must often be valuable." The committee also recommended that "all reports of accidents should be made available to the public." Furthermore, it urged that "all reports should be available as soon as possible after the accident and no avoidable delay should be tolerated."

Public Accountability; Public Information

The accident to which we allude—for, as we have said, a near miss is very much an accident—took place six weeks ago. Two days after it happened, Sir Laurence Sinclair, the Ministry's new Controller of Ground Services, declared in an after-dinner speech (in another context): "Our ATC systems are as advanced as any in the world, and our ATC officers are absolutely unrivalled anywhere." So often is this asserted that it must be true; but confidence in its truth is not strengthened by an accident in the London Control Zone about which Sir Laurence's Ministry refuses to talk.

It is at the best of times disquieting that the Ministry should carry out the investigation of accidents, because as often as not it is an interested party. As long ago as 1948 the Newton Committee recommended the complete separation of the Accidents Investigation Branch from the Ministry and the establishment of an independent Civil Air Accidents Board. The Minister rejected this recommendation, and the recent Cairns Committee did not press the point—mainly on the grounds that the Chief Inspector of Accidents is in any case independent of his Minister.

Perhaps he is; but there is public disquiet that he may not be. This can only be allayed by greater public accountability. The Accidents Investigation Branch of the Ministry must be *seen* to be independent. We therefore recommend that the branch should have its own public information office, independent of the Ministry's information office. In the widest interests of air safety, the Cairns Committee recommended, "more information should be made available to the interested public." We agree. Secrecy does not beget safety.

Meanwhile, why *did* two jets nearly collide in the London Control Zone on February 21?

FROM ALL QUARTERS

Sir William Farren Retiring

AFTER 46 years' work in aeronautical research and development and in the aircraft industry, Sir William Farren, CB, MBE, DSc(HON), FRS, MIMechE, HON FRAeS, HON FIAS, is retiring shortly from active duty on the Hawker Siddeley Aviation and A. V. Roe boards. He has, however, accepted an invitation to continue his association with Hawker Siddeley Aviation as a consultant. He is 68.

During his career he has held senior positions at the Royal Aircraft Factory, Farnborough (1915-18), University of Cambridge (1920-37), Air Ministry and the MAP (1937-41). From 1941 to 1946 he was Director of RAE Farnborough; since 1947 he has been technical director of A. V. Roe & Co Ltd. He joined the Hawker Siddeley Aviation board in 1959. Sir William is a Fellow of the Royal Society, Honorary Fellow and Gold Medallist of the RAeS (of which he was president, 1953-54) and an Honorary Fellow of the Institute of the Aerospace Sciences of the United States. He is an Honorary DSc of Manchester University.

Sunderland Preserved

WITH the handing-over of Sunderland ML824 to the Short Sunderland Trust at Pembroke Dock last Saturday, the efforts of the trust to preserve one of these famous flying-boats came to happy fruition. A gift from the French Admiralty, ML824 was flown in from Brest last Friday by a French Navy crew; it was handed over at a ceremony the following day by Capitaine de Fregate H. Luthereau (station commander at Lanveoc Poulmic, where the aircraft had been based) to Mr H. Oswald Short, who received it on behalf of the trustees. This representative of a famous line is now being preserved at Pembroke Dock, where it will be preserved by the Pembroke Squadron of the Air Training Corps and RAF personnel who worked on Sunderlands.

The campaign to this end began two years ago, when an appeal was made for £15,000 to fly one home from New Zealand. Subsequently, however, this expense was avoided when Air Chief Marshal Sir Philip Joubert, AOC-in-C Coastal Command from 1941 to 1943, made a personal appeal to the French Admiralty, who provided one of their Sunderlands free of charge.

Scottish Aviation Orders

AMONG new orders which have been announced by Scottish Aviation is one placed by the Government of the Federation of Malaya for ten Twin Pioneer Series 3 aircraft for the Royal Malayan Air Force, whose four existing Twin Pioneers are being returned for conversion to full Series 3 standards. (In last week's issue, it was incorrectly stated that this order was for the Government of the Mali Federation in West Africa.) A photograph of a Twin Pioneer and two Prestwick Pioneers of the RMAF is published on our Service Aviation page, p. 422.

Scottish Aviation's repair and maintenance work on RCAF equipment—overhaul, repairs and modifications of Sabres, T-33s and CF-100s—"continues at a high level." The company have never, as was stated, overhauled Orenda 14 engines for the RCAF. A redundancy which was referred to took place in July 1959; since that date, the labour force has remained relatively stable, at 1,800.

From Hamilton Place to Londonderry House

A FIRM indication that the Business Aircraft Users Association is getting down to business without delay was given by the chairman of the Royal Aero Club, Col C. F. H. Gough, in his report to the annual general meeting of the club on March 22. He announced that Sqn Ldr R. R. Stevenson, aviation secretary of the club, was leaving to become chief executive and secretary of the BAUA. Sqn Ldr Stevenson succeeded Mr Maurice Imray as the club's aviation secretary in May 1960.

Sqn Ldr Stevenson (left) and Mr Alec Lumsden

The new aviation secretary, who takes up his position on April 1, comes to the Royal Aero Club from the Royal Aeronautical Society. He is Mr Alec Lumsden, an assistant secretary of the Society and secretary of its Historical Group. Mr Lumsden has been a member of the Royal Aero Club since 1959.

Joint-user Airways

ON Tuesday of last week a Transport Command Britannia, XN404 *Canopus*, flew from London Airport to RAF Aldergrove with a party of Press, MoA and Air Ministry representatives on a visit to the Air Traffic Control radar unit at Bishops Court on the County Down coast. This was the first time the Press had been invited to visit Bishops Court, first of the ATC radar units set up with joint RAF and Ministry of Aviation approval for the control of military and civil aircraft in the upper airspace (above 25,000ft) over the United Kingdom. The implications of these units (the others in current operation are at Hack Green in Cheshire and Sopley near Bournemouth) were discussed and described in an article, *Military Air Traffic Over Britain*, in *Flight* for August 19 last year.

The Britannia made a radar climb-out from LAP, flying to Lichfield along Amber One then turning to the north-west along Red Three. A commentary was broadcast en route, and during it a Service aircraft "Zulu Hotel" was heard calling Hack Green

LUTON LIGHTS UP: Controllable-intensity runway, approach and threshold lights are now in operation at Luton Airport, which has also been equipped with visual glide-path indicators and an identification beacon. Equipment was supplied by GEC and installed by C. Maurice Contractors Ltd at a total cost of £35,000

TAKING A LONG VIEW: Below, the Decca Type 80 surveillance radar at Bishops Court, the ATC radar unit on the County Down coast (see news item, "Joint-user Airways," this page). The rotating aerial weighs 11½ tons and the equipment has a range of up to 180 miles

ELEGANT EXECUTIVE: On March 21 a Grumman Gulfstream (two Rolls-Royce Dart turboprops) arrived in this country to begin a three-month demonstration tour of Britain, Europe, the Middle East and Africa. As reported on page 413, the Gulfstream will participate in the Paris Show

asking for an airways crossing; it subsequently entered Green Two two miles west of Great Orme's Head. Conditions could not have been less radar-like, with strato-cumulus at about 10,000ft; and between London and Lichfield at least three aircraft were seen passing *Canopus* in opposite directions. The Britannia was flying at about 14,000ft, comfortably within the airway; the service which it was taking Press representatives to visit is designed for civil and military jets flying above airways in what are now known as upper air routes.

At Bishops Court, which comprises the RAF aerodrome (on a care-and-maintenance basis and little used for flying) and the radar station at Killard Point, the Air Office Commanding UK air traffic service, Air Cdre H. J. Hickey, stressed that the fact that Bishops Court was an RAF station was "co-incidental"; its function was that of an ATC radar unit: as such, it was one of the positive steps being taken to continue the development of air traffic control over the UK. Air Cdre Hickey explained that because existing airways had imposed restrictions on military traffic, the RAF had developed a system of radar stations, making available a number of radar frequencies. In the summer of 1959, extended trials were held at Bishops Court; these were changed to experimental trials towards the end of the summer last year. He stressed that the service is still under development, requirements for ATC varying in different parts of the United Kingdom.

On Killard Point there is long-range, short-range and height-finding equipment; 30 frequencies are in use and there is a 50-line switchboard for landline communications. The upper air range is 180 miles, the range of the secondary search radar is 120 miles; the height-finders can operate respectively up to 200 and 120 miles. The commanding officer at Bishops Court, Wg Cdr W. H. Pope, said that the unit had been on the air to everyone who called them. From the date since the unit began operations in July 1959, to the end of December last year, 10,000 aircraft (4,000 civil and 6,000 military) have been provided with radar service in the upper airspace. Current rate is about 500 civil and 300 military per month. More details of the Bishops Court radar unit will be given in next week's issue.

Hawker Siddeley Aviation Posts

TWO appointments have been announced by Hawker Siddeley Aviation. Mr G. C. I. Gardiner, CBE, MIMechE, FRAeS, is to join the board as technical director (guided weapons). He will be responsible for co-ordinating activities in the guided weapon and space fields.

The company have also announced the appointment of Mr E. F. T. Jenkins, BCom, as contracts manager (military). He will be directly responsible to the chief executive, Mr J. T. Lidbury.

Calibre and Learning

WITH the future of the university air squadrons at present under consideration by the Air Council, there was a subdued air of optimism at the Southampton UAS annual dinner, held at RAF Thorney Island last Friday. Certainly if two of the principal guests, Air Marshal Sir Richard Atcherley and Prof E. J. Richards, could have their way there would seem to be no doubt about the UAS future. Sir Richard stressed how much the RAF had benefited in the past from the embodiment of "intellect and individuality" in famous scientists like Sir Henry Tizard and Prof Lindemann; many of its famous leaders had come from the universities; and Lord Trenchard, who started a university scheme, had " no doubt about it." Prof Richards, many of whose students in the Department of Aeronautics and Astronautics are members of the UAS technical flight, paid tribute to the squadron as being among the largest in the country though belonging to one of the smallest universities.

Sqn Ldr A. A. Pearce, the commanding officer, said that with official assurances that there would always be a need for manned aircraft the aim of the squadron had been restated. This revised aim "placed a greater emphasis on the attraction of men of good calibre and learning into the Royal Air Force." He paid tribute to Prof Richards, whose students were "among the most active on the squadron," and to Air Marshal Atcherley, whose achievements "form a short history of the Royal Air Force." It was pointed out as a matter for pride by Acting Plt Off M. Z. Webber that the Schneider Trophy course where in 1929 Sir Richard achieved 329 m.p.h. is now part of the Southampton UAS flying area.

IN BRIEF

The Australian Minister of Supply, Mr A. S. Hulme, announced recently that Britain had bought 30 more Jindivik target drones from Australia. This brought Britain's total order for Jindiviks to 130.

Air Cdre B. P. Young, CBE, has become Assistant Chief of Staff (Intelligence) at Allied Air Forces Central Europe headquarters. He was formerly Assistant Chief of Staff (Operations and Intelligence) at Allied Forces Central Europe.

A 180-strong research group is to arrive in Australia in April to continue tests of the upper atmosphere started last November. Operating from the RAAF base at East Sale, Victoria, the group will use Lockheed U-2s and take air samples at altitudes of up to 70,000ft.

After a 22-month test programme, in which 2,000 flights were made without an accident, the Northrop T-38 Talon supersonic trainer (two GE J85-5 engines) entered service with the USAF Air Training Command on March 17. Impressions of flying in the T-38 were published in *Flight* for March 17.

British Aircraft Corporation's tactical corps-support missile Blue Water will be seen in public for the first time either at the Paris Salon (May 26 to June 4) or at a special showing in Britain beforehand. Blue Water mock-ups will be demonstrated on their transporter/launcher by a team from the Royal Artillery.

A "Ladies' Forum" is being held by the London Society of Air-Britain on Wednesday, April 5. Members of the panel will include Mrs Elizabeth Overbury, official instructor to the WJAC; Miss Mary Goldring of *The Economist*; Mrs Gaby Schreiber, design consultant; and Mrs Sarwar Moheyeddan, in charge of PIA passenger relations at LAP. The president-elect, Mr S. B. Oliver, chief test pilot of Hunting Aircraft, will be present and the meeting is to be held at the Holborn Central Library, 38 Theobalds Road, London, WC1.

A French Notam has announced that, from April 1 to October 31, aircraft not fitted with radio equipment for air-ground communications will not be allowed to land at Le Touquet.

The Australian Federal Government intends to buy at least 40 helicopters for the Australian Navy and Army (who together will receive most of the equipment ordered) and the RAAF.

The Earl of Bective has had to relinquish his appointment as sales manager of Lancashire Aircraft Co Ltd, following the death of his father (the fifth Marquis of Headfort) and his succession to the family estates in Ireland.

The Indian Defence Minister, Mr V. K. Krishna Menon, said in New Delhi recently that the first Indian-built supersonic aircraft, the Hindustan HF-24 Mk 1, has been undergoing "satisfactory" preliminary trials. Designed by Dr Kurt Tank, the HF-24 is a single-seat fighter powered by two Bristol Siddeley Orpheus BOr.12 turbojets with afterburners.

A resolution empowering the Northern Ireland Government to lend Short Brothers & Harland up to £5m for the development of the Belfast freighter [*Flight*, March 16] was recently approved in the Northern Ireland House of Commons. The Minister of Finance, Capt T. O'Neill, said that the company had every confidence in the aircraft and were planning to manufacture not fewer than 30.

At the dinner of the Coachmakers and Coach Harness Makers Company at the Mansion House last week, the Lord Mayor (Sir Bernard Waley-Cohen) and the Lady Mayoress were welcomed by the Master, Sir Reginald Verdon Smith. In his speech Col G. A. Norris said that the Coachmakers Company had quickly moved from coach-making to adopt the motor industry and then the aircraft industry, and were now considering makers of spacecraft.

Missiles and Spaceflight

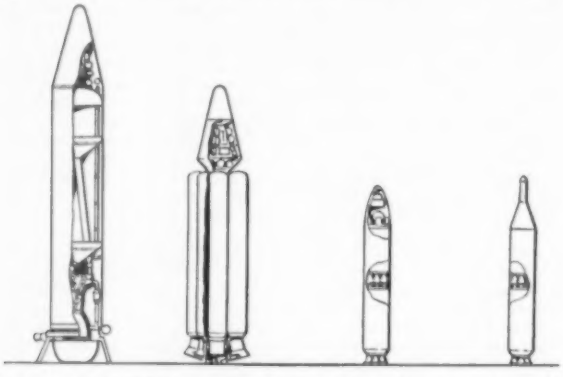
POLARIS ROUND-UP

NEW information on the US Navy's Fleet Ballistic Missile System is constantly being cleared for publication, and it is appropriate to gather recent disclosures into an integrated feature.

New engineering details In the outline of the early design of the Polaris missile published in *Flight* for July 22, 1960, the history of the project was traced from the original liquid-propellant Jupiter IRBM via a cluster (6 + 1) solid-propellant "sea-going Jupiter" to the final miniaturized weapon of today. An accompanying sketch depicts the intermediate solid Jupiter configuration, and serves to emphasize the magnitude of the achievement of the Special Projects Office in evolving the definitive weapon.

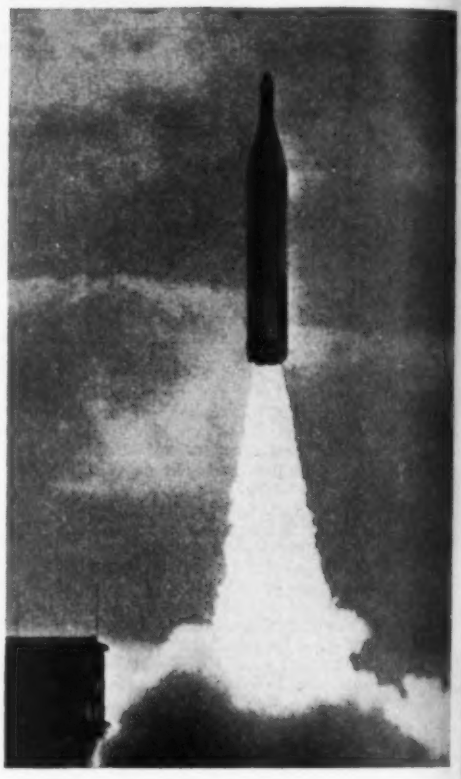
Polaris A-1 is approximately 28ft 3in in length, 54in in diameter and weighs approximately 30,000lb. Design range is 1,200 n.m (1,380 miles) and each of the two stages of propulsion contains a polyurethane propellant with light-metal additives to increase specific impulse. Each stage has a metal case and four nozzles with jetevators. The 30ft 9in A-2 has an essentially similar propellant, but the lengthened first stage and glass-wrapped second stage increase the range to 1,500 n.m. (1,725 miles). The filament-wound second-stage case is at present being manufactured by Allison under subcontract to Hercules Powder Co.

New submarines As British readers know well, the first FBM submarine to become fully operational with the 14th Submarine Squadron is SSB(N) 599 *Patrick Henry*, illustrated in one of the photographs. SSB(N) 598 *George Washington* is technically opera-



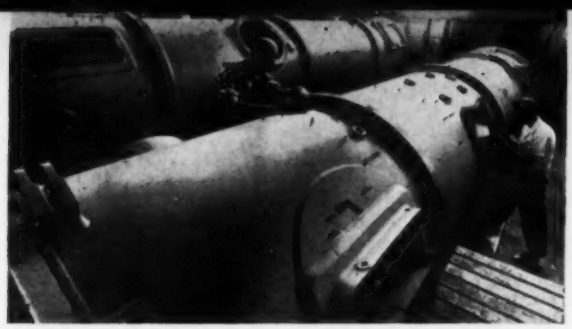
Major technological advances, particularly in solid propulsion, inertial guidance and miniature thermonuclear warheads, allowed Polaris to be made small enough to fit a submarine. Left to right, the Jupiter land IRBM, the "seagoing Jupiter," the original Polaris proposal and the Polaris A-2, which equals or surpasses Jupiter range and warhead yield

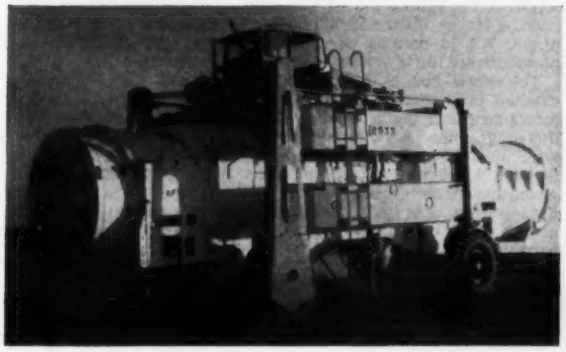
Flight trials of the extended-range A-2 have so far gone well, with four of the first five shots achieving all test objectives. This 1,500 n.m. version will be in service in 12 months' time; the 2,500-mile A-3 should become operational by the spring of 1964. A total of 80 Polaris A-1s were fired during its test programme, 65 achieving all test objectives



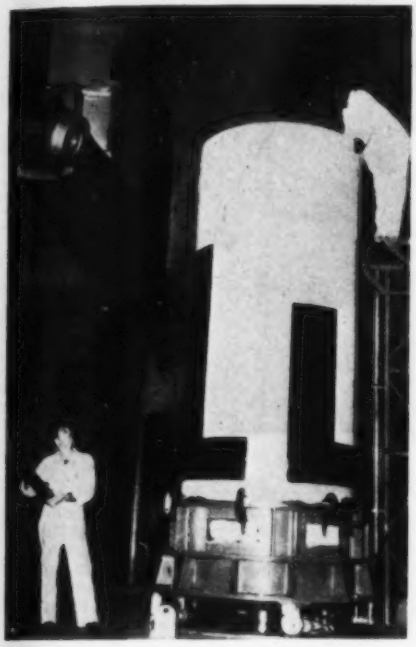
Now fully operational with the 14th Submarine Squadron, USS "Patrick Henry" (left) is based on the depot ship "Proteus" now stationed at Holy Loch

Right, opposite page: Depot ship for the 14th Submarine Squadron is the 18,000-ton USS "Proteus"





Three aspects of Polaris manufacture and supply: Right, submarine launch tubes undergoing final inspection in the Westinghouse plant at Sunnyvale, Cal; below, a Polaris A-2 first-stage motor case being inspected by the 10m-volt Linac at Concord, probably the most powerful high-energy X-ray unit in the world; and, lower right, a completed missile, in a shock- and environment-proof container, being handled by a Clark straddle carrier



THE COST OF POLARIS (thousands of dollars, per fiscal year)

	1956	1957	1958	1959	1960	1961 *	Totals
ding, conversion	—	29,620	378,275	716,739	122,042†	677,032	1,923,708
ce, ammunition	3,000	2,600	52,656	297,554	314,000‡	—	669,810
ment of missiles	—	—	—	—	—	244,591	244,591
, development	17,750	64,130	115,313	279,100	—	—	476,293
aluation	—	—	—	—	220,000	373,609	593,609
construction	—	22,225	18,000	52,449	4,416	11,280	108,370
and related pro-							
ment	—	—	—	65	150	—	215
procurement	—	—	—	—	—	13,383	13,383
m, maintenance	—	720	1,604	11,365	19,275	23,444	56,408
Totals	20,750	119,295	565,848	1,357,272	679,883	1,343,339	4,086,387

sional legislation. † Excludes transfer of funds for acceleration 6.7 million. ‡ Excludes transfer of funds for acceleration 36 million

tional, but has to bear a heavy load of operational development, training and indoctrination programmes. SSB(N) 600 *Theodore Roosevelt*, 601 *Robert E. Lee* and 602 *Abraham Lincoln* are all in full commission, the last-named having started sea trials on February 1. The following day SSB(N) 609 *Sam Houston* was launched at Newport News, following 608 *Ethan Allen*, launched in November, as the second of the new series of enlarged submarines, with a surface displacement of 6,900 tons.

Operational Deployment Each ship carries 16 Polaris missiles in vertical launch tubes (see illustration) from which they are expelled pneumatically. Normal submerged operation is at "quiet" speeds, i.e., below about 5kt. Emergency "dash" performance is probably of the order of 30kt, and at such speeds pursuing craft would probably make too much noise themselves to hear the submarine. Cruising depth appears to vary between 200ft and 400ft, and *Patrick Henry* certainly exceeded the latter figure on her 11,000-mile submerged voyage to Holy Loch earlier this month.

Mother ship of the 14th Submarine Squadron is AS-19, USS *Proteus*. This 18,000-ton ship (see photograph) is based at Holy Loch, Scotland. Last year a contract was let for the construction of an entirely new submarine tender, and it has been unofficially reported from Hong Kong that its location will probably be Guam, in the Marianas. Eventually 45 FBM submarines will be in commission, all but the first five being capable of accommodating the A-2 missile. Each launch tube has its own air supply, and under ideal conditions all 16 missiles can be fired at the rate of about one per minute. Rate of fire on the surface is longer, since the water ballast for the empty tubes has to be pumped aboard through pipes.

Missiles and Spaceflight . . .

ESRO STARTS WORK

On March 13 and 14 the Preparatory Commission of the European Space Research Organization (ESRO) held its first meeting in Paris in the old UNESCO building. By an agreement signed in December at an intergovernmental conference in Geneva (*Flight*, December 16, 1960), 11 West European countries undertook to investigate the possibilities of co-operation on space research, including the use of satellites, and the Paris meeting was the direct result of the ratification of this agreement by member-countries and the voting of the £62,000 budget for the enquiry and planning phase. All 11 nations were represented at the Paris meeting, plus Austria as an observer.

The overall task of the Preparatory Commission is to draw up a detailed programme of research and a time-scale, and then to recommend the budget and organization required to implement this programme. A year is allowed for this work, and in Paris there were indications that it might be completed sooner. When the detailed assessment of the situation is complete another intergovernmental conference will be called to set up a permanent organization. The budget for the permanent organization and the actual space operations that it will undertake is estimated at roughly 100 times that for the Preparatory Commission's work, or about £6m per year.

Much of the first meeting of the Preparatory Commission in Paris was inevitably taken up with procedural matters. An executive bureau of six members was established; this is composed of the commission president, Prof Sir Harrie Massey (United Kingdom); two vice-presidents—Prof L. Broglio of Italy and Prof H. C. van de Hulst of the Netherlands; the executive secretary, Prof P. Auger of France, and the chairmen of the two working groups—Prof L. Hulthen of Sweden and a nominee of the Federal German Republic yet to be named. Each of the member countries is to be represented on each of the working groups. The key working group is that on scientific and technical matters headed by Prof Hulthen; the other is concerned with legal, administrative and financial questions.

Because it would be impossible to shape a legal, administrative or financial policy without knowing what one is financing or legislating for, the scientific and technical working group has been charged with preparing a two-part report to be ready for presentation at the next meeting of the Preparatory Commission, which is scheduled for Holland in mid-May. The first part of the report will deal with "a programme of selected projects to be undertaken as soon as possible (say in a year from now)"; the second part is to be concerned with a long-term programme of projects to be undertaken later on. In relation to both programmes the group is charged with considering "not only the scientific desirability of the proposed projects, but also the technological implications as well as the time, personnel and funds which such projects would require."

There is no doubt that the scientists behind ESRO mean business and have no intention of letting time slip away between the setting up of the permanent organization and the initiation of practical work. Nor are they allowing the slow progress of the proposed Blue Streak project to cramp their deliberations.

IMPLICATIONS OF SPACE

Speaking at the Northampton College of Advanced Technology, London, on March 23, Mr G. K. C. Pardoe, chief weapons research engineer of de Havilland Aircraft, gave details of an eight-satellite communication system on which his company had completed an economic study. Based on two rings of four satellites orbiting in two polar planes, this system should produce the financial results indicated in the diagram (col 2).

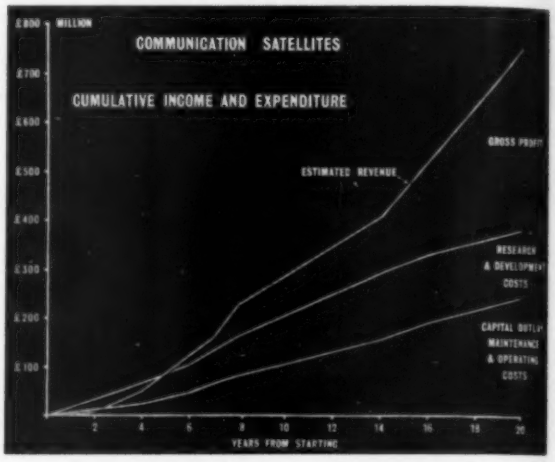
Delivering a lecture on *Implications of a National Space Programme*, Mr Pardoe commented that, if Britain did not embark on a major space project, the effect of the lack of technological stimulus would be serious. Quite apart from general technology, this country was at present only scratching the surface of scientific research in space with the US/UK Scout experiments—valuable though they were. They formed a pilot project which should be backed up by a more comprehensive programme that was more under our control.

In the field of the direct exploitation of space, we would lose even more by not owning the means to send such equipment into space. Dependence on US rockets to establish, say, a communication satellite system was a naïve hope in a hard commercial world.

It was a pity, said Mr Pardoe, that he could not divorce his remarks from Blue Streak, to avoid the accusation of having a vested interest in the principles he was advocating. But only Blue Streak could bridge the gap between the pre-space age and the future.

Space, Mr Pardoe said, would soon become a military arena. It was already the greatest prestige arena in the world; demonstrations of technical ability in space could influence export markets directly in terms of hard cash. If European countries could not penetrate space by their own means they would have no influence or bargaining power whatever in aerospace matters of the future, whether peaceful or belligerent.

After referring to ESRO and the proposed European launch-vehicle organization, the speaker said that it was the lack of any one central co-ordinating person or group in this country which had contributed to our present difficulties. There was no Minister with overall responsibility for the work going on in the Ministry of



Aviation, Office of the Minister for Science, General Post Office and the Ministry of Defence.

Valuable research and other civil and military activity could be conducted, the speaker claimed, within the payload capability of Blue Streak. Some 2,000lb could be placed in a 300-mile polar orbit using HTP and kerosine, and this could be improved by 50 per cent using a lox/hydrogen third stage. With the latter rockets 24-hour communication satellites could be established if required, and payloads of 700-800lb could be placed in the more probable 6,000-mile polar orbits. Space probes of several hundreds of pounds could then be contemplated for exploration of the solar system.

TENTH SOVIET SPUTNIK

The tenth artificial Earth satellite to be placed in orbit by the Soviet Union—fifth of the heavyweight "spaceship" satellites—was launched on March 25 and successfully recovered later the same day. It carried yet another dog, and other biological specimens. The official Tass announcement stated:—

The fifth Soviet spaceship satellite was placed into orbit around the Earth on March 25, 1961. On the same day, at a command from the Earth, the spaceship satellite was successfully landed in a predetermined area of the Soviet Union.

The weight of the fifth Soviet spaceship satellite was 4,695kg (10,350lb) without the last stage of the carrier rocket. On board the spaceship satellite was a cabin with an experimental animal, the dog Zvesdochka (Starlet, a bitch) and other biological objects.

Preliminary investigations and examination of the landed spaceship satellite have shown that the condition of the experimental animal is normal.

The main aim of the launching of the fifth spaceship satellite and the systems installed in it was to investigate further the conditions that must be created to ensure man's vital functions during flight in space and the return to Earth.

The fifth spaceship satellite followed an orbit with a pre-calculated duration of 88.423min. The perigee was 178.1km (111 miles), the apogee 247km (153 miles) from the surface of the Earth, and the angle of the orbit in relation to the Equator was 64° 54′.

In addition to the dog Zvesdochka the spaceship satellite also carried telemetrical, television and radio systems which functioned normally during the flight.

MERCURY-REDSTONE SUCCESS

A Project Mercury spacecraft carrying a "dummy man" was successfully fired down the Atlantic Missile Range from Cape Canaveral on March 24. It reached an altitude of 115 miles and a downrange distance of 311 miles. The test was intended to prove the modifications made in the rocket system as a result of earlier Mercury-Redstone flights.

EXPLORER 10 LAUNCHED

Carrying instruments for the study of the so-called solar wind, a stream of ionized gas believed to pour outwards from the Sun, the NASA satellite Explorer 10 was launched into a highly eccentric orbit from Cape Canaveral on March 25. The satellite weighed 78lb and its orbit was designed to have an apogee of no less than 120,000 miles.

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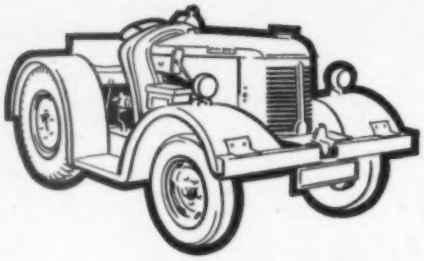

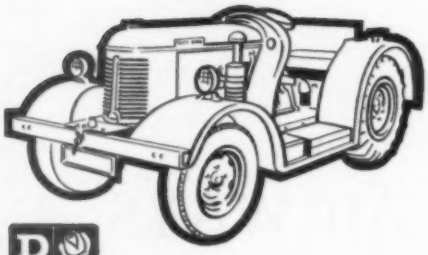

like the albatross

...the modern aircraft, a picture of power and grace when in flight, becomes awkward and unmanoeuvrable on the ground. Fortunately there's usually a David Brown tractor on hand to tow the earthbound giant wherever it may be needed. David Brown machines are used at most of the major airports to ensure rapid ground movement and control of aircraft.

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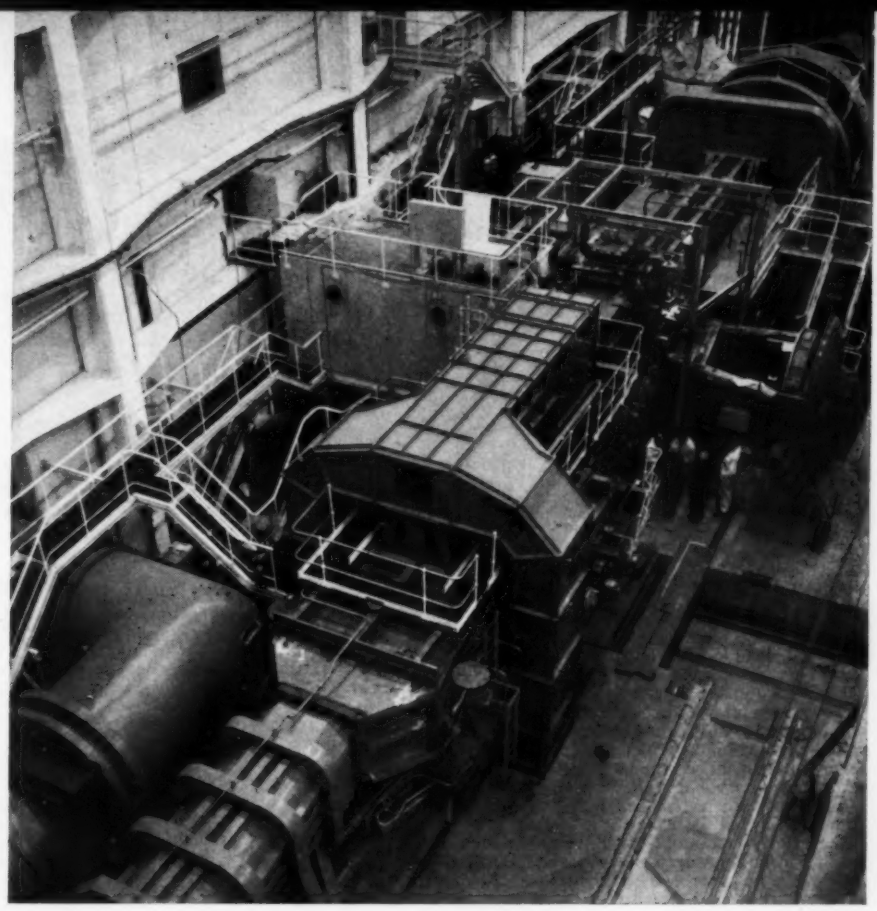


1 General view of working-section leg, looking upstream

Bedford's New Tunnel

2 The observation room

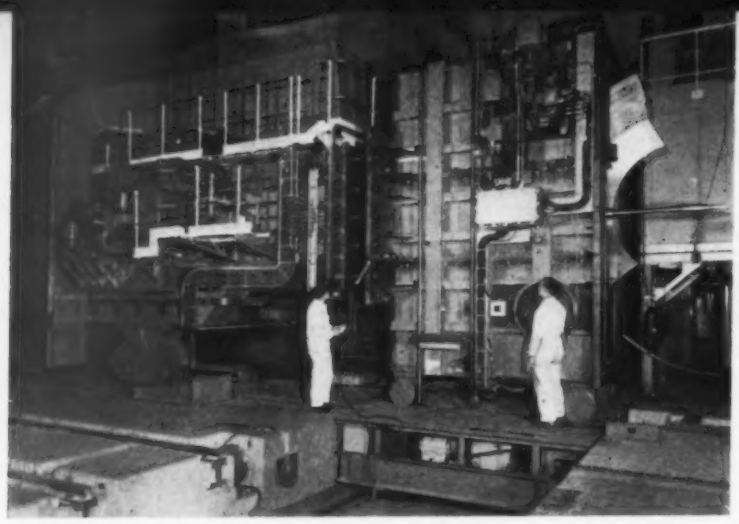
OFFICIALLY opened by the Minister of Aviation on March 24, the new 3ft × 4ft supersonic wind tunnel at the Royal Aircraft Establishment, Bedford, is the fourth and fastest of Bedford's major facilities. At present operating at a fixed speed of M4, the new tunnel is designed eventually to be continuously variable in operation from M2.5 to 5 and will complement the work of the large (8ft × 8ft) M2.8 tunnel at Bedford.

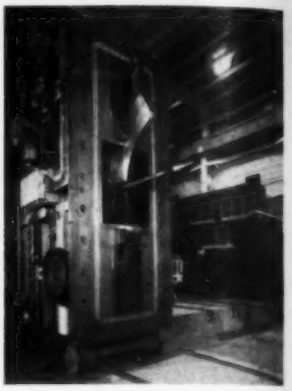
Design and construction of the tunnel has involved a joint effort by staff of the Ministry of Aviation, Ministry of Works and the companies responsible for particular items. Models up to 5ft in length can be accommodated in the tunnel, and the same models can be used when required in other similar facilities such as the 8ft Bedford tunnel and the M4 English Electric facility at Warton. The new tunnel at Bedford is continuous in operation and can produce inlet total pressures up to 12 atmospheres and air temperatures up to 150°C.

The tunnel circuit as originally designed (see diagram 6) includes a nozzle with flexible top and bottom walls to permit the continuous variation of throat gap and wall contour; a number of interchangeable model-support sections; and a supersonic diffuser with adjustable walls forming a second throat. During the design and manufacture of tunnel components it became evident that, because of the new engineering features of the flexible nozzle, this unit would take longer to complete than the rest of the tunnel and plant. Thus at present the tunnel is operating with a fixed (M4) throat and contour nozzle made by the Ministry of Aviation; it is expected that the definitive nozzle—which, together with the complete working-section leg of the tunnel and its associated servo-controls, is the responsibility of the General Electric Co—will be in operation in about two years' time.

Air entering the tunnel (photograph 1) is first expanded into the settling chamber, 9ft 6in in internal diameter and containing five stainless-steel wire screens for smoothing out fluctuations in the airflow. In the contraction fairing the tunnel cross-section changes to the rectangular throat of the nozzle, which at present is 3ft wide and 4in high. The test section at the downstream end of the M4 nozzle is 3ft wide and 4ft high, and the model is viewed from the observation room (photograph 2) by means of closed-circuit television and a Schlieren system.

Model-support sections are interchangeable (photographs 3 and 4) and are changed by unlocking and moving the downstream section of the working-section leg; placing the model-support





Bedford's New Tunnel . . .

section on its transporter and withdrawing it at right angles to the tunnel axis into the rigging bay; and inserting another section on which the next model is supported. The model is fitted on a quadrant-mounted sting, on which incidence may be changed from $-5°$ to $+27°$ with a range of roll-angle of $\pm 180°$.

Downstream from the model-support section, the supersonic diffuser has two hinged side-plates, enabling the throat width to be varied between 16in and 34in (at a constant height of 4ft) and the tunnel to be operated at lower pressure ratios than those required for starting. Immediately after this diffuser is the subsonic diffuser, a long transition section in which a 7ft diameter circular cross-section is attained.

Two identical compressor and motor sets are provided (photograph 5), working together in parallel. Each set is driven by a 34,000 b.h.p. synchronous motor and a 10,000 b.h.p. induction motor which is used to drive the synchronous motor up to speed and thereafter to contribute part of the required power. Each compressor set has an 18-stage, low-pressure axial compressor and an eight-stage, high-pressure centrifugal compressor. The two machines in each set can be run either in series (to give a high pressure ratio and low mass flow for high Mach number) or in parallel (to give low pressure ratio and high mass flow for low Mach number). A pre-cooler, inter-cooler and after-cooler are fitted. Auxiliary plant includes four vacuum pumps, two air compressors, together with six high-pressure storage cylinders. The main air-compressor machinery and much of the associated equipment has been supplied by AEI.

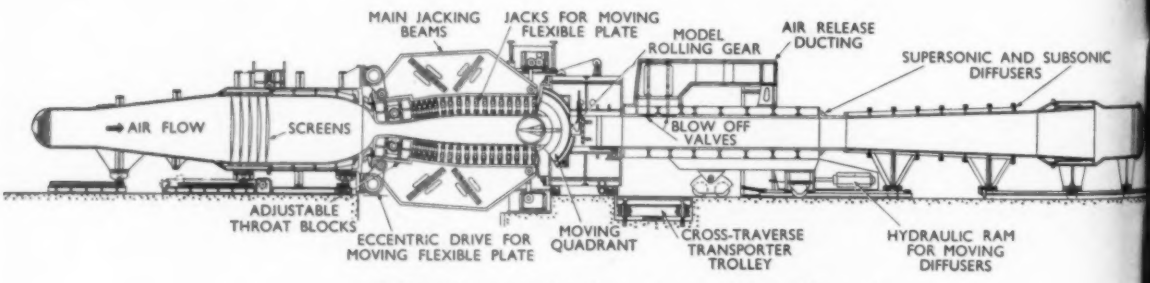
The tunnel is controlled from a series of rooms on a raised deck between the compressor hall and the working-section hall. The plant control room has a direct view into the compressor hall and contains all the controls for the main and auxiliary plant. Next to it is the observation room, in which the tunnel operating conditions are controlled once the compressor sets have been run up to speed, and in which the results from the model area are observed and recorded. There is also a data reduction room.

With the present wooden nozzle, as mentioned, the Mach number is fixed, and stagnation temperature is limited to 40°C. The tunnel can be operated at stagnation pressures up to 8atm at M4, and 12atm at M5. Sub-atmospheric pressures are used for starting and stopping, and the pressure is continuously variable during running. The tunnel generally comes close to achieving flight Reynolds numbers and in many cases will actually achieve them.

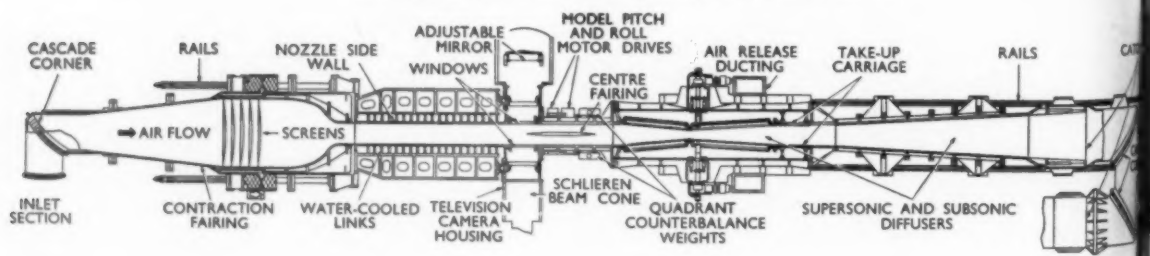
3 *Above, model-support section being inserted in tunnel*

4 *Above right, model-support section on transporter*

5 *Right, the compressor hall*



6 *155ft working-section leg, showing design of 26ft flexible nozzle*



Below:—

1 *Both engines running, down the slipway . . .*

2 *. . . and out into the Solent for a 40kt dash*

3 *Impact as the lift engine is chopped . . .*

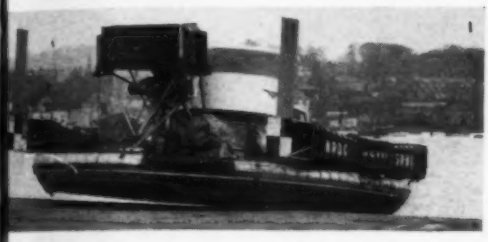
4 *. . . leads to gentle taxying on Maboré power*

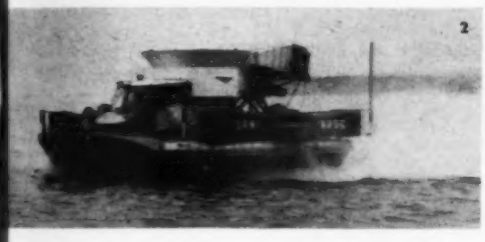
5 *Full lift-throttle pulls N1 over the slipway*

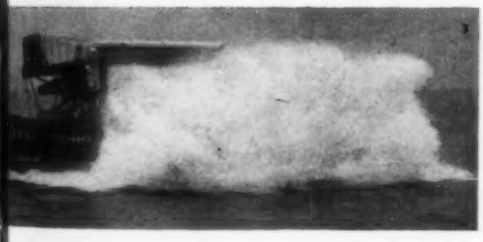
Off the Ground

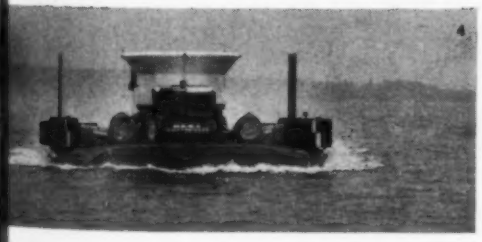
by Alastair Pugh

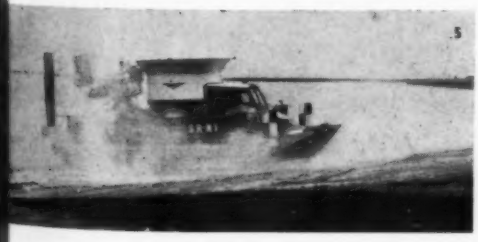
No 2 of the Series • The Saunders-Roe Hovercraft











THIS article is the second in the series of hovercraft air tests. The first, of the single-seat Rhoades Hoverscooter, appeared in "Flight" for November 25, 1960. Although the present test took place over water, the title is still applicable to the SR-N1, on which nearly half the total time airborne has been over ground

SOME 270 airborne hours have now been accumulated by SR-N1, Britain's first Hovercraft. For a vehicle which was designed for an original life of ten hours, this is astonishing. Even now its usefulness as a test vehicle is by no means exhausted, and next month the propulsion Turboméca Maboré is to be replaced by a Bristol Siddeley Viper ASV.8, increasing total thrust from 1,250 to 1,600lb. This will allow a most useful extension of the flight envelope.

Though SR-N1 has been shown to be at fault in many respects, its value as an introduction to practical hovercraft has been truly outstanding. The many lessons that have been learned are already being incorporated in a whole range of new British air-cushion riders, of which perhaps the most advanced is the 60-seat SR-N2, now about half completed at Cowes.

Two of the great advantages of N1 must be its comparatively generous size (apart from the Swiss *Ilen*, it is still the largest air-cushion rider in the world) and the ease with which it can be flown. After watching Cdr Peter Lamb at the controls for perhaps 20min last week, I was able to start, hover, cruise, and go through long, fast sliding turns over water with only the briefest of promptings. More skill is required for manœuvring in confined spaces, but—with respect to Peter Lamb's very polished handling—proficiency here seems to be mostly a matter of application. The basic techniques can apparently be very easily learned.

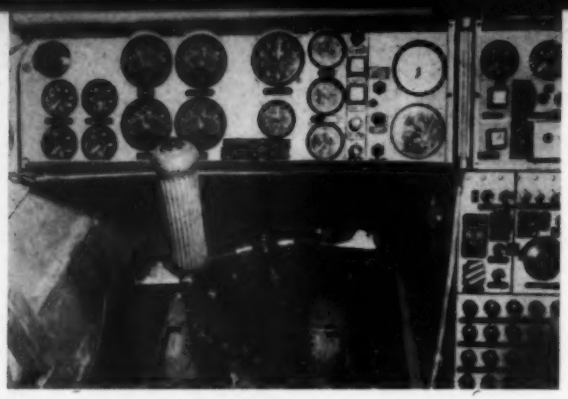
N1 scales over six tons, retains its first experimental control system, and has both piston and gas-turbine engines. It carries 70gal of petrol and 125 of kerosine, enough for a safe duration of one hour. Recalling imperfections of control of the diminutive Hoverscooter flown a few months ago (*Flight*, November 25, 1960), I found N1's amenability to control most reassuring. Much work may remain to be done to improve it, but a reasonable solution has already clearly been found.

A number of changes have been made since N1 last publicly appeared, the most obvious of which is the addition of a large knit-mesh intake for the propulsion Maboré. This is to filter out salt water that was reaching the engine, and experimentally to examine the effect of side intakes. Another experimental modification is the addition of rubber skirts. Attached to both inner and outer peripheral ducts, these taper from front to rear. Their purpose is twofold: to increase effective hover-height now that weight has gone up from 8,900lb to 13,000lb, and to attempt to reduce nose-down pitching, caused at speed by the thrust-inclination of the propulsion engine. Another, earlier, modification was a chordal increase in the size of the aft rudders; weathercock stability could then more easily be overcome.

Doors on each side of the cockpit give access to rather cramped accommodation for pilot and observer; a third person can be squeezed in to stand behind the non-adjustable seats. There are no straps, but earphones are needed for radio and intercom—at full power the Alvis Leonides lift-engine is noisy.

Primary control is the right-hand stick, moving fore-and-aft in a graduated quadrant. Hold the stick forward, and the craft accelerates. Pull it back, and there is reverse thrust through the propulsive ducts. Centralize it, and air is directed equally fore-and-aft. This response is achieved by a pair of swinging sluice-gate valves in the two longitudinal ducts, which accept one-third of the air blown down the "funnel" by the fan. The remainder passes into the plenum chamber and out through the peripheral slots to form the air curtains and cushion. Total forward thrust with the Leonides at full throttle, and with stick fully forward so that the rear valves are wide open, is 500lb. This was the sum of propulsive thrust until the Maboré was added last summer.

[*continued overleaf*



Cockpit layout is simple; the right-hand stick controls fore-and-aft propulsion and on top of it is a twist-grip to govern hover-height. Pitch and lateral trim are adjusted by the left-hand stick. Instruments are kept to the minimum; the larger four grouped dials show selected cylinderhead temperatures in the Alvis Leonides lift engine

Off the Ground . . .

These gate valves are positioned each side of the T-junction in the trunking. They work differentially fore-and-aft, and in unison side-to-side, in response to movement of the stick. Their action can be observed from the cockpit, but the control is a fairly coarse one. Stick-load is high, particularly forwards, but in a cruise case a friction nut at the pivot can be tightened to relieve the load.

Lateral and pitch control are influenced—hardly more—by a stick on the left. It has two planes of freedom. Control surfaces are spring-loaded spoiler flaps over the inner and outer curtain slots, which are deployed to destroy a segment of the air curtains, thus inclining the platform and adding a thrust component to lift. Fore-and-aft spoilers are about 2ft long—the lateral ones rather longer, as the side curtains are weakened by air ducted-off for propulsion. Maximum inclination that can be achieved with the pitch-and-roll stick is about 1½°, though that control would be more effective were the spoilers larger. It is sufficient to hold the Hovercraft beam-on to a light cross-wind; for anything stronger the solution is simple—turn into wind. Elevons in the propulsive ducts were found ineffective and were abandoned early on.

A pair of adjustable aircraft-type rudder pedals complete the directional controls. They operate on rudders at each end of the longitudinal ducts, those at the forward end being for control in reverse. Pedal loads are light, even at maximum speed.

Hover-height is controlled by r.p.m. of the Alvis engine, varied by a throttle twist-grip on the propulsion-control stick. There is no "altitude" control other than a tachometer; and, as pitch of the fan is fixed, there is no pilot's control over boost, although a manifold pressure gauge appears on the panel. The only other variable control, for the Maboré, consists of a simple throttle lever and friction nut on the port side of cockpit. Initial travel opens the high-pressure fuel cock—it is as simple as that.

On the hardstanding at Cowes, Peter Lamb ran through the starting procedure. First, a quick visual check on the plastic pipes carrying kerosine and petrol upwards from the deck tanks; then, petrol pump on; ground-flight switch on; magneto switches on; a prod on the starter button; and the Leonides burst into life. A turn on the twist grip and the lift engine settled down to a steady rumble at 1,000 r.p.m. The next action was to turn on the kerosine pump, crack open the H.P. cock and hold in the two-stage starter button until the Maboré lit up. A mirror on the cockpit keeps the engine in view. Careful throttle-control is necessary to keep j.p.t. under 600°C until the Maboré is properly burning and turning at 11,000 r.p.m. We were ready to go.

At 1,600 r.p.m. on the lift engine N1 began to lighten, and as the engine accelerated to its governed maximum of 2,900 r.p.m. the craft rose to hover 10in over the hardstanding. We were at maximum weight of 13,377lb and slightly nose down. Manœuvring outside the hangar required judicious use of directional rudder control and some busy pump-handling on the propulsion control stick. The Maboré was left to idle. Lamb switched on the pilot's high-speed rotary wiper and a second traverse type on the passenger's windscreen. We turned slowly towards the slipway, accelerated, and rushed forwards and downwards towards the sea.

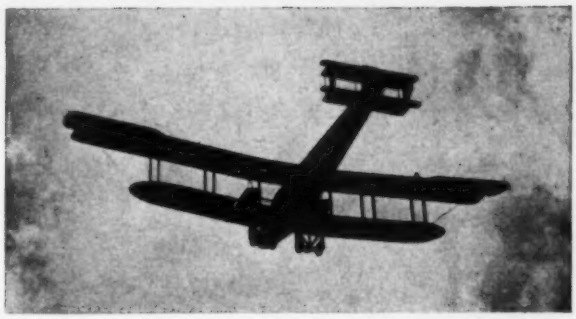
The expected splash never came. The Hovercraft dipped its nose, lifted and rode steadily 10in above the water, bobbling over the waves like a rowing boat. A great cloud of spray seemed to engulf it completely. Lamb pushed the propulsion stick forward, opened up the Maboré and we gathered speed towards the open Solent. Progress at first seemed disappointing. The Hovercraft seemed to make heavy weather of acceleration, and visibility through the spray was virtually nil. But suddenly the water mist began to diminish and N1 pressed forward with most satisfactory urge. The wave which, as we were hovering, had formed in front of depressed water under the hull had been over-ridden. We were over the hump and on the downhill side of the drag curve. With both throttles wide open the Hovercraft slammed ahead. Noise was considerable. The trim stick was brought back to lift the bows, but the effect was small. N1 covered the water in a series of short fore-and-aft oscillations—like a well-damped car on bumpy road, or the chop of a speedboat (but without the smack of hull against water). Occasionally the front skirt slapped against a wave, breaking-off the crest, and as we crossed the wake of a steamer pitch amplitude increased.

To stop quickly a considerable momentum must be destroyed. At 30kt Lamb closed down the Maboré, kicked on full right rudder and the Hovercraft rotated, hardly deviating at all from its previous track. It pirouetted almost on its vertical axis. Half-way through the turn he snatched back the propulsion stick to give a full 500lb of reverse thrust and then, as the nose came round, slammed it forward again. Still following its original line, the Hovercraft stopped; the pilot snapped shut the twist grip and the Hovercraft came to rest only 50yd from where the spin was commenced. Peter Lamb climbed out to lower the water-speed probe, and we changed places.

I wound open the twist grip and the Hovercraft lifted off. Even with zero forward speed, directional control was good—drifting slightly downwind I could, without difficulty, point the nose in any direction. I selected an into-wind heading and pushed the propulsion control fully forward. Spray mist surged up over the bows and drenched the screen beyond the capability of the wipers to clear it. Then I opened the Maboré up to full 21,000 r.p.m., with j.p.t. at 560°. At 10kt on the sensitive water-speed indicator acceleration was sluggish. Then the Hovercraft cleared the hump, and at 15kt the mist dispersed and we skimmed away over the water. Distances shrank and the sensation of speed was exhilarating.

A slight beam wind made it necessary to compensate for drift in order to hold a required track; to make track corrections I used rudder to swing the nose through double the change in heading. When the required track-change had been achieved I brought the nose back on to track. Every turn is a skid, and a high-speed turn through 180° consists of one long drifting slide; the analogy with a fast car out of control on an arena of ice is inescapable. A third of the way round a fast turn the Hovercraft may be riding sideways over the water at a full 30kt clip and with up to 1½g lateral acceleration. Momentarily it feels out of control—the sensation is unlike that of any other air or water-borne vehicle; in car terms one can only say that the Hovercraft is in a state of vast oversteer. I reduced hover-height a few inches by throttling the revs by 300 r.p.m. and speed increased by 2kt. I couldn't understand why, until Lamb explained that reduced momentum drag through the intake offset decreased propulsive thrust. Under ideal conditions N1 has exceeded 58kt water speed, and with the Viper should reach 65kt. Future hovercraft may use Doppler speed-measurement technique; a number of trials have already been carried out, and problems of accurate measurement over running water are under investigation. SR-N1 has also been used to investigate navigational methods. Decca is preferred, and there is talk of a moving-target system being developed, in which the trace moves over a stationary map. There have been demonstrations to the Army and water-borne forces; commercial operators are interested and there are applications to be explored over land and coastal and inland waters. N1 has carved its own niche in history.

Back at the harbour the Hovercraft demonstrated its tractability by taxying in the water up to the approach to the slipway. There was a surge of power as it lifted off, rushed up the slipway gradient, checked with reverse thrust, hovered, and dropped quietly back on to the hardstanding.



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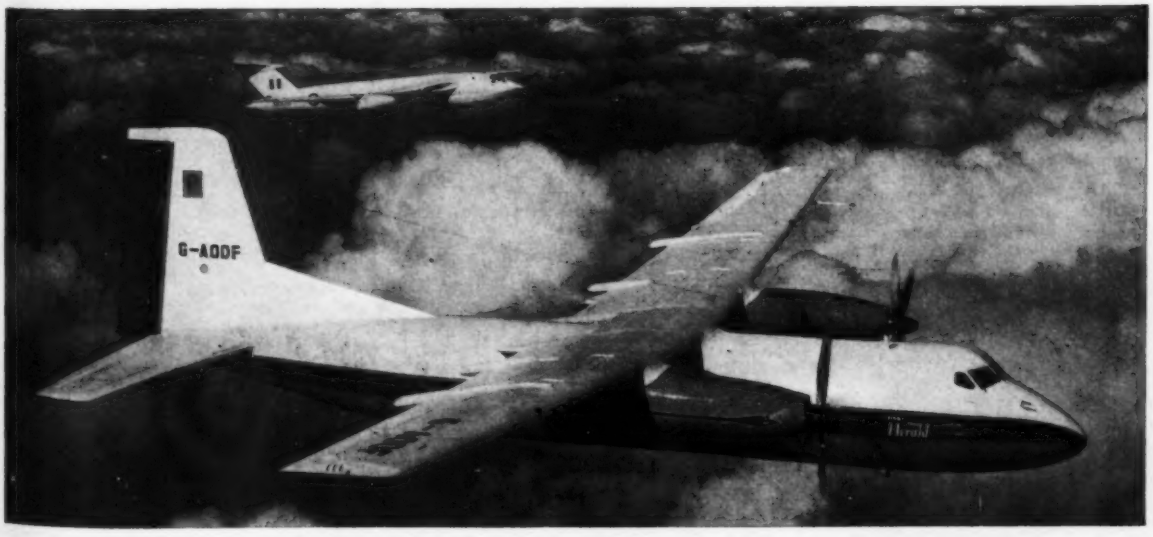

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The New Shape of the Industry

as seen by

SIR ROY DOBSON

CBE, Hon FRAeS, JP

Managing Director, Hawker Siddeley Group

in an interview with FRANK BESWICK

IF there had been time to put one question to Sir Roy Dobson on matters apart from aviation and politics (his answers on the latter subject are not recorded here) it might have been to ask about his recreation. One feels that the answer would have been "work."

Before Mr Sandys, in that autumn of activity in 1959, told the leaders of the aircraft industry what was in his mind about their future, the Hawker Siddeley Group was already a massive empire stretching out far beyond aviation, and Sir Roy's responsibilities were already very wide. "It was not *I* who wanted these extra organizations," he explained at one point. But the twinkle in his eye suggested that he had not been averse from taking on the extra work which the added slice of aircraft industry must have entailed.

Moreover, as will be seen from the answers to questions which follow, Sir Roy's approach is direct and simple. If the British industry can be further strengthened by making even larger groups, that, it seems, is the sensible course to adopt. My first question was a general one about the industry as a whole.

We have had all these changes in the British aircraft industry; would you say the present shape is about as effective as we shall, or can, get?

"No, it seems to me that we have failed in this. The idea was to get two main groups on the aircraft construction side, but there are at present two large firms outside altogether. They are both taking good technical men."

Do you mean that because the two big groups are not all-embracing it lessens their efficiency?

"I mean that it lessens the efficiency of the industry as a whole. There are these loose ends, and they should be tidied up. We all want technicians, and it really is not good enough that there should be this competition for them. I think this is a major criticism."

Apart from the possibility of further changes, looking at your own group as a national asset, in what way would you say its efficiency, or competitive capacity, has been improved as the result of recent changes?

"We have brought into the group the civil experience and connections of de Havilland—that is a major development. If the group is to participate in civil projects then that is where the work will be done; other organizations in the group have the military experience. Now, being blessed with hindsight, if we were starting all over again I would have put the 748 project into de Havilland."

But what about the individuals involved? There is a school of thought which holds that if you have more designers, for example, working together they strengthen and help each other; is that your experience?

"Oh, design, research and development—that's a different thing. We now have more strength there in the group as a whole. We swop about a good deal and exchange ideas and help. We have a team of about a hundred men quite separate from the manufacturing companies; they spend their time examining the feasibility of all kinds of projects and considering what we should be doing in the future. Moreover, they are available if trouble breaks out with any one of the manufacturing companies.

"We have a case right now where four companies are all co-operating in solving certain problems. Another company is calling upon two others in the group. We have a lot of experience to draw upon, and it gives greater strength to each part of the group."

Have you one individual to co-ordinate or act as design leader for the group?

"We have a technical leader in S. D. Davies, the technical director for HSA. He spends his time visiting all the companies; he knows the situation and he knows who to bring in if trouble arises. And he would present a case to the Ministry.

"On the missile side there is Guy Gardiner—formerly leader of the Blue Streak team; he is our authority on missiles, and he can see that there is proper co-ordination."

You have spoken once or twice, Sir Roy, about the necessity of avoiding overlapping between the two big British groups; how would you propose to eliminate this without inviting all the dangers of a complete monopoly?

"Well, you have a virtual monopoly in any case. But what I have wanted to do is to put up a united British front. I think it is eminently sensible to keep out of one another's fields. The British market is not large, you must agree; it cannot be cut up. One or other of the two big groups has to have the business in any one section of the British market, and after that the competition is just wasteful. After all, from the country's point of view, it is the export orders that count.

"What I wanted to do was to decide on what should be our national projects—have some arrangement for sharing experience and resources if you like, but not two opposing projects in the same field; that way, neither of us could possibly make any money. Or, looking at it from the country's point of view, we might both miss the export orders."

You speak of a national project; is it not necessary also to think in terms of an international project—in a supersonic transport, for example?

"Some people talk in these terms, but there will need to be a master-mind in a project like that, and if we are going into the business seriously we shall have to scheme it here in Britain. There might be sub-contracting to other countries, and we might be co-operating in other ways; but when it comes to putting the machine together and flying it, that must be done here."

What about your proposals for co-operation with SEREB; what is the next step there?*

"We have put our case and discussions are going on, but the next step is with the Government. The proposals are realistic financially and I think the technical case is accepted—especially for the communications satellite. But, of course, it needs Treasury approval."

We spoke a little earlier about the division of responsibility as between your own group and BAC; would you accept that it would be reasonable to draw a line which gave the work on a supersonic transport to the one company and space developments to the other?

"No; for one thing, the design work on either of these would not provide all that much subsequent employment. I believe it is essential that Britain takes these space proposals seriously, if only because we shall learn so much that will be applied elsewhere—in metals, techniques and miniaturization for example, but the actual amount of work involved for us is not so great.

"The same thing applies to design-studies on supersonic aircraft. What we really should do there is to aim at a feasible transport machine to fly within the next eight or nine years and order eight or nine of them for the RAF. Let them accumulate experience, and then we should have something for the commercial market in the 1970s.

"It is not only research contracts that are wanted. We need development work. There is VTOL, STOL, jet flap work, and so

(Concluded at foot of page 403)

* Société pour l'Etude et la Realisation d'Engins Ballistiques; see page 270, *Flight*, March 3.

"Flight" photograph

DEBONAIR in the Air

BY ALASTAIR PUGH

No 141 of the series

LATEST of the single-engined four-seaters to appear in this country from America is the Beech Debonair. It is Beech's new venture into marketing performance at a competitive price. The Debonair is intended, quite simply, to compete with the Comanche 250 or Cessna 210—a market in which the refined, high-performance Bonanza is outpriced.

Delivered to United Kingdom agents, Short Bros Light Aircraft Division and Aircraft Associates, duty paid, the basic Debonair costs £9,995. This is over £2,000 less than the Bonanza and undercuts the Cessna 210 by £319. A standard Comanche 250 costs £9,748, so any advantages that the Debonair can show do not have to be offset against higher price.

Beech have a reputation for producing a quality product in terms of both structure and finish, and their reputation stands high as a result. At 2,900lb maximum all-up weight, Debonair load factors are +6.6 and −2.64 g, indicating a robustness of structure that exceeds that of any equivalent type.

The Debonair is, of course, a new younger brother to the long established vee-tailed Bonanza. Lighter and simpler, the Model 35-33 Debonair has as its chief distinguishing characteristic a conventional tail, adapted from that of the Mentor trainer and added at the end of the Bonanza airframe. The Continental flat six which powers the Bonanza is also repeated, but as the IO-470-J it is detuned from 250 to 225 h.p. Cost is saved in other directions by simplifying the interior and standard equipment, and offering as optional extras a wide range of instruments and ancillaries. Among these are the tinted rear windows of Mr Weymann-Hale's demonstrator which, although not adding much to the pilot's already good view, increase visibility from the rear seats and let in more light.

My first impression of the Debonair was that it stands quite high off the ground, the all-metal airframe apparently not making any great concessions to all-out aerodynamic performance. Mixed mushroom and flush riveting—the latter very neatly executed—is used throughout the structure. Light skin-gauges covering the tail unit are deeply swaged for stiffness. In comparison with the laminar-flow sections sported by some of the Debonair's contemporaries, wing profile is conventional. The wrapped skin of the leading-edge torsion box is smooth, but there are span-wise discontinuities in the surface where the skin butts against the capping strip on the spar.

All panels and doors fit well, and fuselage skin joints are flush; overlaps appear to have been completely avoided. Cowling of the fuel-injection powerplant is neatly carried out; and the exhaust-runs and overboard drains, which protrude from the rear exit duct, are tidy. From the joint on either side of the thrust line the complete upper cowling panel can be removed by undoing eight recessed screws.

Scaled up, the nose leg would grace any airliner. Toggle links are diminutive forgings, the leg has a minute shimmy damper, and there is a landing light on the Beech-designed oleo. All wheels are completely covered by doors when retracted and the undercarriage—Beech fashion—is stressed for a 600ft/min descent.

Flaps and ailerons share the entire trailing edge in about equal proportions, and an adjustable aileron bias is now a standard fitting. The rudder has a fixed tab; and both elevators carry surprisingly large trim tabs which project well beyond the trailing edge.

Access to a cockpit with plenty of head room is by a non-retractable step, an ample rubber-covered walkway and a forward-opening door on the starboard side. There is a raised grab-handle on the fuselage. Adjustment of the front seats is limited to about 4in, but all seats are easy to enter. Knee room in the rear is plentiful, but there is space for up to 270lb of bulky baggage in a compartment immediately behind them. Optional instruments, radio, and a full load of passengers and fuel can trim this allowance severely. Disposable load of the basic aircraft is 1,170lb. Allow 122lb for full optional equipment and 313lb for standard (40 Imp gal) fuel, and four 170lb passengers must make do with 14lb baggage apiece. There is a lockable baggage door on the starboard side, but you can reach for your sandwiches over the back seat.

The most striking feature of the cockpit is the throw-over column and wheel, released by a pawl on the central pillar and locked in a high or low position either to the left or the right. The big rudder pedals can be adjusted as well. On the aircraft tested there was no backlash in the wheel system, and friction was negligible.

A turn of the key switch and a prod of the starter button brought the IO-470 rumbling into life; the only unfamiliar vital actions are to push the fuel control right home to the maximum-pressure position and to prime with the auxiliary pump until pressure shows.

A rotary selector forward of the pilot's seat routes fuel from either main tank or from the auxiliary wing tanks to the large-capacity pump. About 8 gal/hr is rejected and passed back to the main tank selected. When the two linked 8½gal auxiliaries are feeding, fuel is passed back to the left main, so this is the tank to be used up first.

Except directly upwards, visibility on the ground is of the glass-case variety. The pilot sits close to the cockpit wall, which improves his view forward, but I found it was difficult to look back through the additional window on my side. The port windscreen pillar was slightly obtrusive, but otherwise the clear windscreen and tinted side windows are excellent, curving well up into the roof. There is a small d.v. window on the port side.

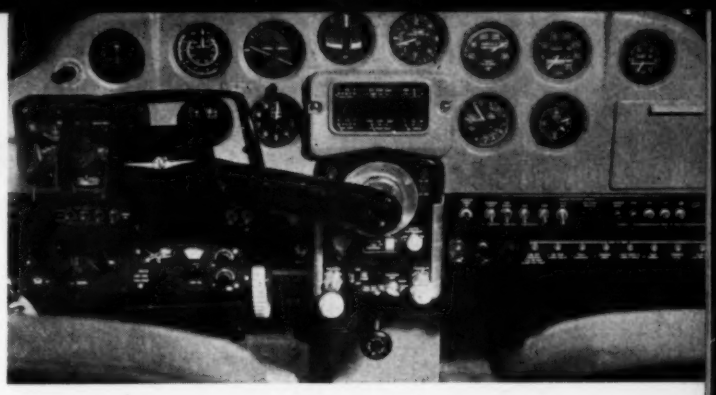
The long-stroke high-absorption oleos gave a wonderful ride. In contrast to the effort required to steer the nosewheel, through 17° either side, toe-brake pressures were light. Single-disc differential brakes were effective. With the nosewheel castoring the full 29° each way one-and-a-half-span turns can be made.

Take-off with everything forward gave readings of about 29in boost, 17lb/sq in fuel pressure and 2,600 r.p.m. After a slight initial tendency to swing left, the Debonair ran as if on rails; at about 60 m.p.h. some control feel developed and a slight backward pressure rotated the aircraft smoothly into the air at about 65 m.p.h. A no-flap take-off is standard, but wheels are cleaned up electrically by means of a switch just to the right of the console, on which a spring-loaded pull-out knob engages up or down detents. Lights on the console show when the undercarriage is locked up and locked down, but go out while it is in transit. A mechanical indicator, linked to the nose gear, is mounted on the aft wall of nosewheel well, which protrudes into the cockpit.

The first few minutes were stimulating. Aileron control, though not over-powerful, was of beautiful quality and very light. Wheel forces were a little heavier, but the control had the same silky feeling. The trim wheel projects from under the instrument panel,

"Flight" photograph

This view of the Irish-registered Debonair demonstrator gives an indication of the excellent cockpit visibility; note in particular the way the windscreen is brought well back over the front seats. Typical of Beech care in design is the stall breaker-strip at the wing root, carefully tailored into a neat pointed fairing



"The most striking feature of the cockpit is the throw-over column and wheel." Although the panel is tidy in appearance, "Instrument layout is rather haphazard . . . the raised central box serves only to over-emphasize the importance of engine temperatures and pressures"

works in the correct sense and, though heavy to operate, is extremely effective. The trim position indicator is tucked out of sight underneath the control slide on the centre of the console.

Instrument layout is rather haphazard. Vernier throttle and pitch levers, with a fuel-pressure knob in between, bear no relation to their corresponding instruments, and the raised central box on the panel serves only to over-emphasize the importance of engine temperatures and pressures.

Rate of climb is moderate, about 1,010ft/min at best climb speed and maximum weight. Corresponding angle of climb is fairly flat, so that view uphill remains good. I reached nearly 4,000ft before clearing the mist and then timed a 1,000ft climb at 103 m.p.h. best rate-of-climb speed in 1min 24sec. This was at 23in and 2,450 r.p.m., about 65 per cent power, and corresponds to 720ft/min. Though there are no cowl flaps, the Debonair may be climbed at full throttle, and a graph in the really good handbook shows best rate-of-climb and angle-of-climb speeds for heights up to the ceiling of 17,000ft.

Like most fuel-injection aeroplanes, the Debonair gives of its best at height. Beech quote 11,000ft for best cruise performance at 65 per cent power and 7,000ft for 75 per cent. Advertised speeds are then 180 m.p.h. TAS on medium power and 185 m.p.h. TAS on high; the latter figure corresponds with V_{NO}—maximum structure cruising speed. V_{NE} is well out of the way at 225 m.p.h., but another limitation that has to be watched—maximum manœuvring speed—is set at 142 m.p.h. This corresponds to undercarriage-down limit speed, but in emergency the wheels can be kept extended up to 200 m.p.h., no doubt because Beech firmly endorse the 180° rating technique (see *Flight*, March 23), which they re-explain in the owner's manual.

At 1,000ft I settled the Debonair to cruise at 155 m.p.h. indicated at 65 per cent power; at 4,000ft it recorded 160 m.p.h. (about 166 true). Noise level was really low and engine vibration most effectively suppressed. Controls were quite pleasantly harmonized, aileron forces being appreciably lighter than those of elevator or rudder; this seems typical of American light aircraft practice.

A degree of spring interconnection is provided between aileron and rudder so that, on ailerons alone, I could roll the Debonair smoothly into turns without adverse yaw. Even a bootful of rudder will not upset its directional stability, and a 5 m.p.h. increase in speed was damped out after one-and-a-half very slow oscillations in pitch. Lateral stability seemed marginal, but was better to the right than to the left.

Closing the throttle and fining-off pitch, I next tried some stalls. There was a long period of deceleration before, clean, the warning light flashed at 70 m.p.h. and a well-defined stall occurred 7 m.p.h. slower. There was brief aerodynamic warning on the point of stall, the controls became sloppy, and the port wing dropped about 30°. With undercarriage and flaps down the warning light flicked on at 65 m.p.h. and the port wing dropped in the same way as before at 57. These speeds were measured two-up and on a fairly forward c.g. Though mushy, aileron control was sufficient to check some of the wing drop, and as the nose nodded forward there was rapid recovery.

With a trickle of power I then attempted to sideslip; but I had insufficient rudder to hold up the nose.

Descending with power pulled well back I encountered the first turbulence in what, up to then, had been silk-smooth air. The Debonair rode it like a boat but with a curious short-term wiggle in yaw.

At circuit height daylight was practically gone, and I was more than glad of the Debonair's big windows and gentle approach. There was a slight nose-up change of trim as the wheels went down and a trim-change in the opposite sense with flap. Electrical actuation of the latter is controlled by a switch flanking the port side of the console. I felt my way down on to finals, progressively selecting greater deflections; flap was adequate, without being particularly powerful. Flap extension is indicated by 10° lines that are uncovered as the surface is lowered, but it seems easier to inch down the flaps as required than to select any particular position for each stage of the approach.

A really pleasant feature of the Debonair is the way in which it follows a groove right down to touchdown, holding its trimmed speed precisely all the way down. At 85 m.p.h. I was a bit fast for an ideal approach, and we floated slightly after applying quite a moderate pull force to round out. When the mainwheels touched the Debonair nodded forward at once on to its nosewheel, but plenty of elevator is available and in a better-judged landing it should be possible to lower the nosewheel more gently. From the trim indicator afterwards I found that I had used less than half of the available range.

Offer me a Debonair for a touring holiday and I'd be off tomorrow. It is smooth and quiet, and with full auxiliary tanks maximum range is nearly 1,100 miles. Perhaps as a character the Debonair is rather colourless; but I think all that this really means is that the transition from sport to transport has now completely been made.

BEECHCRAFT MODEL 33 DEBONAIR
(Continental 10-470-J)

Dimensions: Span, 32ft 9.9in; length, 25ft 6in; wing area, 177.6 sq ft. **Weights:** Empty, 1,730lb; gross, 2,900lb; power loading, 12.9lb/h.p.; wing loading, 16.3lb/sq ft; fuel tankage, 40 Imp gal standard, 57 optional. **Performance:** V_{NE}, 225; max manœuvring speed, 142 m.p.h.; best cruising TAS, 185; stalling speed, 60 m.p.h.; service ceiling, 19,800ft; take-off run, 900ft; landing run, 570ft; range, 845 st m at 143 m.p.h. (45 per cent power) on standard tanks, 1,170 miles with auxiliary tanks.

THE NEW SHAPE OF THE INDUSTRY (continued from page 401)

on, and there are the laminar flow and variable-geometry projects—we must have development work on these things if Britain is going to lead the world. We have the people to do them, but we must have Government support."

What about the Mk 2 version of the DH. 121? You mentioned a year ago that this, rather than the VC11, was the logical candidate for Government support. Do you propose pursuing the Mk 2 project or will you concentrate on the basic 121 for exports?

"We are going on with various developments of the 121. Originally, of course, it was tailored specifically for BEA, and as such it will be useful for others; but there are countries which have their own requirements—more fuel, more passengers, for example—and the aircraft is growing to meet these specifications. The Mk 1 will be ready by October, and we are going on with the Mk 2."

What stage have you reached with the Mk 2?

"It is now in the design stage. We are putting forward designs and guarantees, and as soon as the Trident is out of the way we should be putting the Mk 2 into hardware."

Do you think there is a market for the smaller executive jet?

"Yes. The need is for an eight-seater or something of that sort—a straight jet to cruise at 400kt or more, at proper jet height."

Why do you think that we can get this market when the Americans have already gone so far?

"I believe they have largely missed the boat. We can sell a machine at about two-thirds of their cost, and one with better performance. But any serious aeroplane is going to cost a lot of money, and again there is this question of Government support.

"Most people would be surprised at the cost of developing even a small machine like this. We are not afraid to take risks—when the balance sheet is published you will see the amount we have written-off during this last year—but there is a limit."

The Avro 748 would seem to have been a reasonably straightforward aircraft, but I understand that it is behind in delivery; is that the case?

"We *are* a bit behind, for one reason or another—maybe six months. You should remember that there have been four major fires at the works; we had the roof drop right across the prototype one night. But they are working on the 748 seven days a week, and we shall make every effort to let the operators have the machines they need."

* * *

What special impressions remain from an interview with Sir Roy Dobson, who now oversees such a large area of Britain's aircraft industry?

There is the bluff, northern, no-nonsense approach; the impatience with unnecessary and/or frustrating competition; the insistence on State support; the capacity to think in very big (yet uncomplicated) terms; and that incipient twinkle in the eye. One will watch with interest to see which of these factors has the greatest influence on future developments in the industry.

Straight and Level

"BEA have been told [by a certain trade union] that unless certain points in industrial relations are cleared up quickly, they will recommend their 3,000 members at airports in Britain and Europe to take an hour to 'contemplate the sad state of industrial relations in BEA.'" The situation, a union official says, "is causing tremendous irritation."

Connoisseurs of industrial relations will appreciate that the members of the union concerned want more money, and that BEA don't want to give it to them.

Well, I don't know the rights and wrongs of this particular dispute, but I am intrigued by the latest union euphemism for the word strike. Contemplation . . .

THE EDITOR: "Come now, Bacon, why are you not writing Straight and Level? The Production Editor tells me it has to go to press in half an hour's time, and he hasn't had a single word of copy yet."

BACON: "I know. I'm contemplating."

THE EDITOR: "Contemplating? What do you mean, contemplating?"

BACON: "I am contemplating the sad state of affairs arising from my request for a 10 per cent increase in my salary to £24,000 a year. If Dr Beeching rates that for running British Railways, I reckon I rate it for this job. Straight and Level is of equal importance to the nation. It is now two days since I put in my request, and there is still no decision. I find it tremendously irritating."

THE EDITOR (after one-fifth of a second's contemplation): "Either you write Straight and Level during the next half-hour, or . . ."

So I wrote Straight and Level.

● According to a Reuter report, the chairman of Kegworth Parish Council, Mr R. Sibson, says that airport noise can make people infertile. His council is objecting to a Derby Corporation plan to develop Castle Donington as a civil airport. Mr Sibson says: "We have seen a medical report proving that, in experiments, rats became infertile when subjected to normal airport noise. This could happen to our people and become a serious threat to future generations."

So it looks as though the airport noise problem is going to solve itself after all.

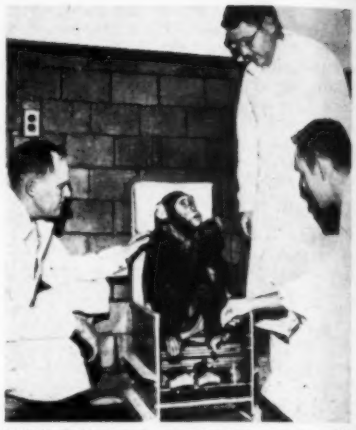
● From an article in *The Service*, Nigeria:—

"You are thinking of going to the United Kingdom; you book your passage through a travel agency, and aimed with your ticket. The day arrives and you sit in a very comfortable chair in a Britannia Stratocruiser at the Ikeja International Airport. You are already flying more than a million miles above the sea level and after covering about 4,000 miles you hear a voice . . ."

As long as it isn't a hand on my shoulder. Anyway, the article goes on: "The average hours flown by Nigeria Airways' pilots are 8,000 hours a year."

● Just announced by Thinx Aircraft Furnishings Ltd is a new range of feather beds, specially designed to replace the seats in airliner cockpits. A large demand is confidently expected, according to Sir Harold Digit-Smith, chairman of the Thinx group of companies.

The feather beds are suitable for installation in most types of modern jet and turboprop airliner, and have what is described as an exceptional coefficient of comfort. Some airlines were at first opposed to their installation, but all have now come round to accepting them as a logical development of the conventional pilot's seat. Very soon, said an airline spokesman last week, "our pilots will be completely featherbedded."



"While Robinson is manicuring my toenails and Smith is brushing my hair, I would like you, Jackson, to get me a large fruit salad"

● The first ideas about aircraft came not from men of science but from writers of fiction. They foresaw them not as vehicles of transport or as weapons of war, but as the means of having wonderful adventures.

Today there is one writer at least who is able to live what others of his calling could only dream. A Hiller press release informs me:—

"America's most prolific author, and creator of Perry Mason—Erle Stanley Gardner—has returned from an adventure-packed helicopter expedition into the unexplored canyons and mountains of Baja California.

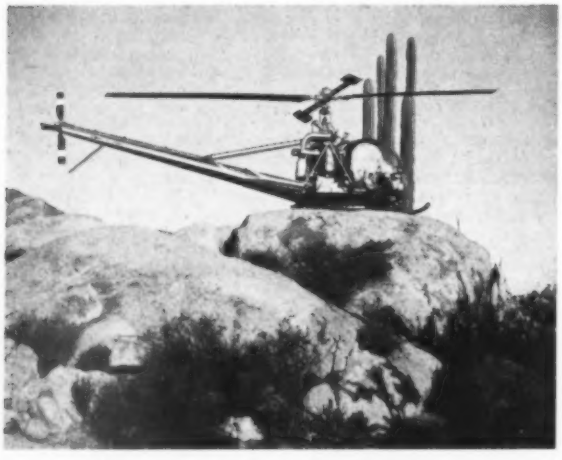
"Using a Hiller 12E to get him into otherwise inaccessible terrain, Gardner and his group of adventurers found palm-lined oases and underground rivers and streams in arid wastes where no water was known to exist. In one remote area they found the remains of large buildings which could well be the fabled lost Mission of Santa Isabel."

There is nothing to beat that in any of Jules Verne's romances.

The Hiller's perch seen in my picture is described by Mr Erle Stanley Gardner as "tame." Often, he says, the pilot would let down on "ridges so jagged that there was hardly a place to step out onto."

● According to Chicago Helicopter Airways, passenger traffic carried in 1957 showed a 6,214 per cent increase on 1956. When did CHA start passenger services? On November 12, 1956.

ROGER BACON



"Nothing to beat this in any of Jules Verne's romances . . ." *See second story, col three*

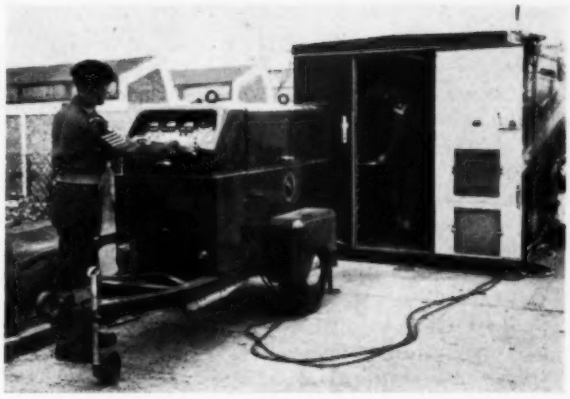
FLIGHT SYSTEM SURVEY

A Standard Telephones team studies Russian in preparation for the British Trade Fair in Moscow. Left to right: Max Settelen and S. E. J. King, Radio Division; J. L. Reynolds, Telephone Cable Division; A. J. Wilson, Transmission Division; D. Bailey, exhibition stand manager; C. T. Gregar, Transmission Division; N. S. Shepherd, Components Group

HF Mobile Station for SHAPE

FIRST of six 1kW transportable HF radio stations ordered by SHAPE has now been delivered by Racal Engineering Ltd. The station is housed in a transportable cabin—made by O. G. Lywood Ltd—and can handle SSB/DSB and FSK communications at between 1Mc and 30Mc/s. The cabin is sealed and ventilated to allow for a wide range of temperature and atmospheric conditions and may be carried by a three-ton truck or by aircraft. A whip aerial can be set up in 15min to make the station rapidly operational; and larger aerials, with two folding masts, are also carried with the station. A diesel-driven generator trailer can supply current in the field.

Racal successfully tendered for the contract, in face of heavy competition from European and American companies, in June 1960; production of the first station, using modified versions of standard Racal units, was begun in August. This month US Army personnel began training with the first complete station. Incorporating TA.127 transmitter and RA.17 receiver, the Racal station is designed to 1963 performance requirements; characteristics claimed include flexibility and stability.



Soldiers operating the first of six Racal Engineering 1kW HF radio stations for SHAPE. The cabin can be carried by lorry or aircraft and is sealed and ventilated

Plug-in Modules for Autopilots

NOW in production at the Transport Aircraft Controls Division of Elliott Brothers (London) Ltd is a wide range of plug-in modules, for Elliott-Bendix PB-20 computer units, and an air data senser. A complete system providing for continuous autopilot control during climb, cruise, let-down and automatic flare-out is being produced for the VC10—it was described in detail in *Flight* for October 7 last year—but the modules can be packaged in any desired combination to suit particular applications ranging from instrument servo control to completely automatic landing. A choice of standard ATR case sizes is also available.

The modules are based on metal cards which can effectively support heavy assemblies such as transformers, motors and gearboxes. There are a score of different modules, including various types of amplifier, electro-mechanical computers, two- and three-channel circuits, controls and relays.

The air data senser and its two monitor units illustrated below form part of the VC10 system and provide monitored outputs of height, airspeed, Mach number and various gain control and switching functions. When used with the appropriate controller, smooth transition from one autopilot lock to another is obtained without the necessity for disengagement. The main senser may be used independently and covers ranges of 0-60,000ft in height, 100kt to 700kt i.a.s. and an equivalent Mach number range. The ranges can be extended for particular applications.

Testing Tacan Receivers

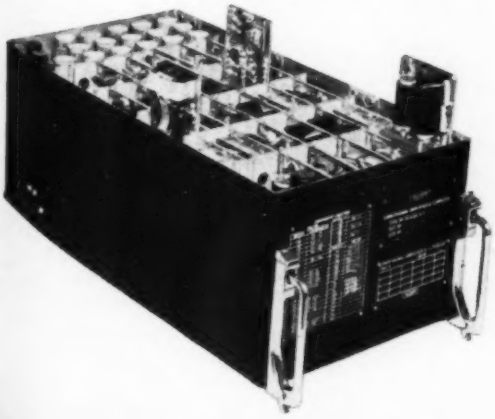
AGAINST stiff competition, G. & E. Bradley Ltd, an associate company of Joseph Lucas Ltd, has won an RCAF order for 60 Tacan test sets. They will be used to check ARN-52 airborne Tacan receivers now being introduced by the RCAF and have been given the designation ARM-501. The order is worth £46,000.

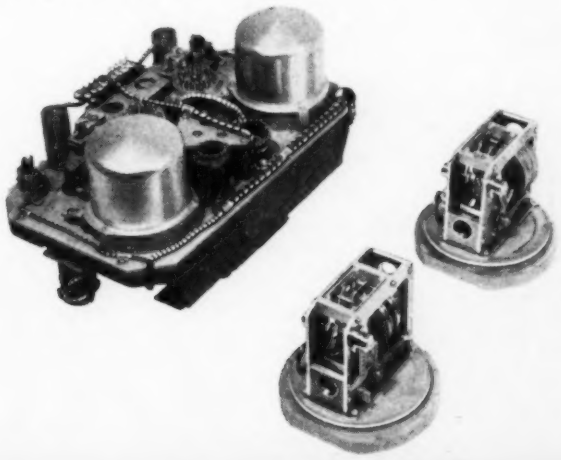
The Bradley test set UE.45 was originally designed to MoA specification and is already being used by the RAF for ARN-21C Tacan and by the Fleet Air Arm for ARN-21. Other test sets have been supplied to American aircraft manufacturers for use on aircraft production lines. The equipment permits pre-flight "go-no-go" checking and simple workshop servicing.

ILS for East Germany

ANNOUNCED at the Leipzig Fair was an order worth £40,000 for a Pye ILS to be installed at Dresden international airport and the latest VHF ground-to-air communications radio for Schoenefeldt airfield and the East German area. Pye ILS is already installed at airfields in Russia, Hungary and Jugoslavia, as well as in numerous others in Canada, Africa, the Middle and Far East and Britain.

Left, an Elliott 1 ATR case containing some of the range of plug-in modules now being produced by the Transport Aircraft Controls Division. Right, the main air data senser and its two monitor units. These form part of the VC10 control system





Speedbird Anniversary

BOAC IS TWENTY-ONE YEARS OLD

NEXT SATURDAY, April 1, British Overseas Airways Corporation will be twenty-one years old. On April 1, 1940, the new corporation took over the assets of Imperial Airways and British Airways. These companies had already become merged in all but name when their fleets were placed at the disposal of the government on the outbreak of war seven months before.

For its first five years BOAC operated in a world at war, performing tasks as diverse as they were important to the Allies' war effort. Links with the Commonwealth, pioneered during the preceding two decades, were kept open in the face of appalling difficulties. New routes were operated and scheduled services across the Atlantic were begun. Passengers and cargoes of strategic importance were carried, often in circumstances of great danger.

In 1945 the corporation emerged from the war with an *ad hoc* fleet comprising seventeen types of aircraft, almost wholly conversions of military machines. Uneconomic to operate, it was with these that BOAC began the long, hard road to commercial profitability. The lack of suitable equipment was to plague the corporation for ten years more; courageous pioneering ventures were met with disappointing and sometimes disastrous setbacks.

In the pictures in these pages, selected at random from the airline's library of over 30,000 photographs and from *Flight*'s own files, we portray some aspects in the history of an enterprise which, born to a baptism under fire and weaned in wartime, has since become one of the great names in peacetime mercantile aviation.

BOAC's first aircraft were inherited from Imperial Airways and British Airways. Here an ex-Imperial Armstrong Whitworth Ensign is seen in wartime paint over Khartoum. Several Ensigns were early casualties in the retreat from France, maintaining a scheduled service to Paris until two days before the city fell

Adaptations of military aircraft were impressed in BOAC service over vital routes. Mosquitos maintained a hazardous link between Scotland and Sweden, carrying very important passengers and consignments of ball bearings. For the VIPs there was very "infra-dig" accommodation. Only two could be carried—strapped in the bomb bay

Long stretches of the "horseshoe" route, linking South Africa, the Middle East, India, Australia and New Zealand were flown until 1945 by the famous Short C-class Empire flying boats. "Cleopatra" and "Corsair" are seen here riding at moorings in Mombasa. "Corsair" had force-landed in the Belgian Congo some months before the war, but a nine-month salvage operation restored her to the fleet in 1940. In the Congo she left behind a new village, Corsairville

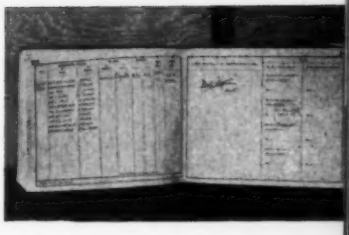
Passengers for a flying boat leaving Poole Harbour, UK flying boat terminal for the duration of the war, undergo the inevitable Customs examination. In this respect air travel never changes, come war or peace

The airline's launches at Poole were manned by women crews . . .

. . . but women were noticeably absent from the corporation's routes through Islam. Arab passengers are here being seen off in a BOAC Lodestar at Jeddah. The corporation's operations in the Middle East did much to sustain British influence in the area during the war years

Sunderlands were introduced to supplement the flying-boat fleet. With military insignia, but with the Speedbird emblem on the nose, Sunderland G for George taxies for take-off at Poole, en route to India . . .

The Boeing 314A flying boats, purchased from Pan American Airways in 1941, flew services between Britain and West Africa. Between every round trip they returned to Baltimore for servicing. An irregular transatlantic service thus began. Here, the Boeing 314 "Bristol" unloads freight from the United States at Lagos . . .



. . . and in the sister-boat "Berwick" Sir Winston (then Mr) Churchill made his first transatlantic flight, returning from Washington early in 1942. Expected by sea, his arrival by air several days early was a security gambit. Not surprisingly, the captain's log makes no mention of this very, very important passenger

. . . Lord Wavell, the Viceroy (second from left), having just embarked

Captains seconded from BOAC were instrumental in starting the Atlantic ferry service, flying Lockheed Hudson from the United States, through Canada, late in 1940. Though these deliveries later became an RAF responsibility, BOAC operated from 1941 a return ferry service with ten converted Liberator bombers, flying back the delivery crews to North America. This scene at Montreal is typical of the conditions under which these unpressurized aircraft operated

Beneath their rough military exterior, these Sunderlands were quite lavishly equipped

Liberators continued to operate non-commercial services over the Atlantic, carrying official passengers, freight and mail, until 1946, when the 2,000th return ferry flight was logged. Capt Donald Anderson chats with a lady passenger after completing the flight

Speedbird Anniversary

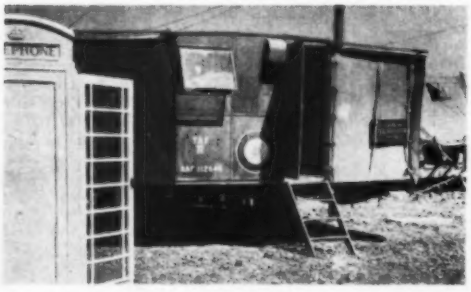
In November 1945, 21-passenger Yorks inaugurated the Springbok service to Johannesburg, in conjunction with South African Airways. At Khartoum this Sudanese cleaner seems particularly pleased

BOAC's first post-war equipment for the new, commercial "Battle of the Atlantic" were five Constellation 049s, delivered in the middle of 1946. The service from London to New York was inaugurated on July 1. On the Constellation flight deck, discussing the new aircraft, are Sir Arthur Whitten-Brown and Capt O. P. Jones, Atlantic veterans both

In the same month Lancastrians, carrying only six passengers in sleeping berths, began the then fastest, longest air service in the world—the 63-hour, 13,000-mile Kangaroo service between Hurn and Sydney. On May 20, the service moved to London Airport. This Lancastrian is seen making the first BOAC departure from Heathrow

At the end of the war, BOAC began to build its big reputation for flying animals. A very important arrival at Poole in May 1946 was this giant panda . . .

. . . another was the chairman, Viscount Knollys, who was returning from a 35,000 tour of the routes in a Hythe flying boat



If its operating equipment left much to be desired in the immediate post-war years, so did the corporation's ground facilities. This was the airline's transport office at London Airport in July 1946

Lancastrians and Yorks bore the brunt of the Commonwealth services at that time, but some were operated by Haltons, converted Halifax bombers. Here a Halton is seen flying past the Grand Hotel at Khartoum, a city of major importance on the Commonwealth routes for many years

In 1947 the then Princess Elizabeth christened BOAC's first Tudor 1 "Elizabeth of England" at London Airport. It was to be the flagship of the fleet and the Tudor 1 and 2 were intended as the mainsprings of BOAC's Atlantic and Commonwealth fleets; a promise which was unfulfilled—the first of several post-war equipment shortcomings

In April 1947 two senior pilots, Capt O. P. Jones and Dudley Travers, were honoured at a luncheon to mark their 30 years of flying. "O.P." is seen here flanked by the chairman, Viscount Knollys, right, and the chairman-designate, Sir Harold Hartley. Capt Jones finally retired from active piloting in 1955

The foundations of the Corporation's just'y praised cabin service were being laid in 1947 at its catering training school. Trainee stewards and stewardesses are here being taught the right way to wake a sleeping passenger . . .

. . . but there could not be such finesse in India in the autumn of that year. Assisted by charter companies, the corporation mounted in September, October and November "Operations Pakistan and India," flying Moslem refugees from India to Pakistan and Hindu refugees from Pakistan to India, on partition of the sub-continent. In Dakotas stripped of all furnishings thousands of refugees were flown to safety. Pilots had a heart-breaking task in resisting the pleas of would-be passengers, with their aircraft already grossly overloaded

In 1948 Sir Miles Thomas was appointed chairman-designate and he took office in 1949. Sir Miles' chairmanship, which he held until 1956, was of great significance in turning BOAC into a profitable and efficient enterprise. Here he steps from a Solent on the opening of the post-war flying boat base at Southampton in 1948, only two years before the cessation of all BOAC's flying boat services

The . . . improved in 1949. On March 29 the first Canadair DC-4M Argo . . . delivered to London Airport. Twenty-two Argonauts ordered for Comm . . . were delivered eight months ahead of schedule . . .

. . . but the type was sceptically received by this Bombay policeman, equipped for the monsoons, on its first proving flight to the Far East . . .

. . . A frenetic welcome awaited it in Natal, Brazil, however, when it made a demonstration flight there the following year

In October 1949 was delivered the first of ten Boeing Strato-cruisers for the Atlantic services. Mr Vernon Crudge, left, accepts the aircraft at Seattle

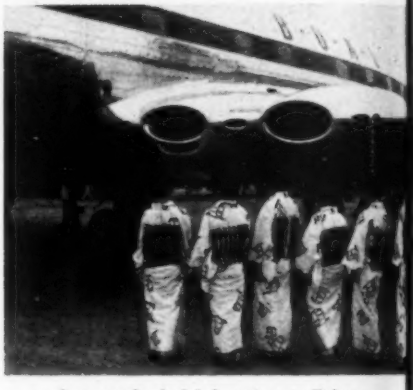
. . . ost-war Br . . . nter BOAC's service was the Hermes, in 1950. The Hermes flew . . . routes and . . . ble grandstand for the sight of Mount Kilimanjaro

The corporation led the world on May 2, 1952, when it introduced into service the Comet 1, the world's first turbojet airliner. Here "Yoke Peter" is waved away to make the world's first commercial jet flight, to Johannesburg . . .

. . . to be welcomed on arrival by these colourful Voortrekkers, seen chatting to Sir Miles Thomas

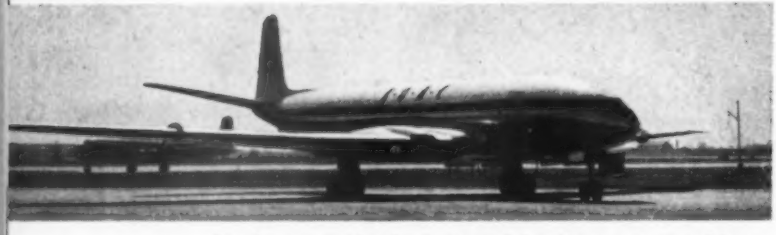
Speedbird Anniversary . . .

The Comet's fame spread, as did its routes. It was seen over the pyramids . .



. . . and operated scheduled services to Tokyo . . .

For ten years the corporation has frequently flown members of the Royal Family about the world. One such flight took the Queen and the Duke of Edinburgh to Entebbe, Uganda, in 1954. The royal carriage was an Argonaut

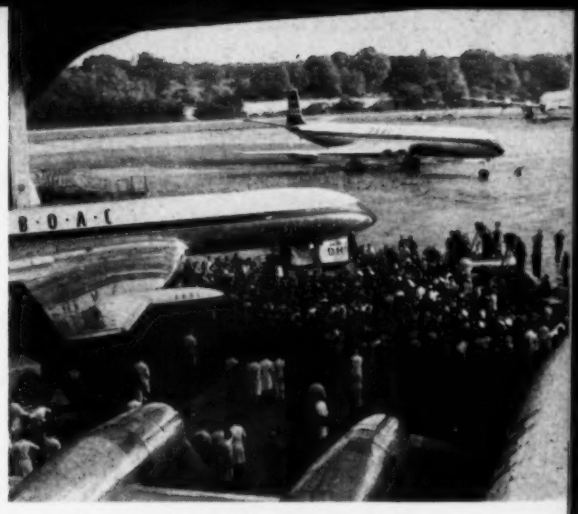


But after two years' airline service and three disasters it was withdrawn. The last Comet to arrive in London after the official grounding returns home from Rome, with only its crew aboard

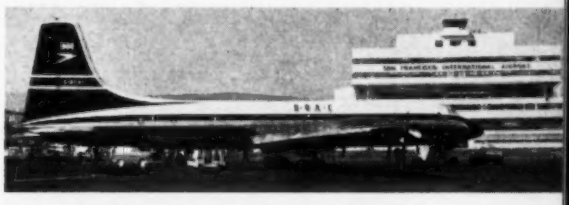
After the withdrawal of the Comet 1, development troubles with the Britannia led to late delivery. There was a hiatus in BOAC's re-equipment during the mid-fifties and its competitive position suffered. After frustrating delays, which led to the ordering of Douglas DC-7Cs in 1955, the Britannia eventually went into service in February 1957; one took the Queen Mother to Fiji in September 1958

The Britannia was an aircraft which posed the corporation a new problem

BOAC's faith in pure jet airliners, and the Comet concept, remained unshaken by the Comet 1 disasters. A fleet of Comet 4s ordered in 1955 and by 1958 Mr Basil Smallpeice, the managing director, was able to check the aircraft's passenger-appeal with the infallible "pencil test"



. . . On September 30, 1958, the date specified three years before, the first Comet 4 was handed over to BOAC. For good measure, the second (in the background) was delivered on that day, too, and the third only two days later



In 1959 BOAC forged the last links in its girdle round the Earth's big waist. Britannias flying westwards, to California, met Comets flying eastwards from Hong Kong. This Britannia 312 is being turned round at San Francisco, its outward terminal

Four days after the first delivery, following "the race that never was," BOAC pipped the other runner at the post in inaugurating the first pure-jet service from London to New York. Eager to be away, "Delta Coca" noses out of the picture as it is waved off from LAP

1960 saw the introduction into service of BOAC's 15 Boeing 707s over the Atlantic and Pacific routes. A 1925 Rolls-Royce and vahines of rather lesser vintage greeted one at Honolulu on a proving flight last November . . .

Comet 4s re-opened the long-defunct services to South America and made the Andes look quite small

A new chairman, Sir Matthew Slattery, took over

Looking forward to the next 21 years, BOAC ordered Vickers Super VC10s in June, in addition to the non-Super ones ordered in 1958. Mr K. H. Staple, secretary, right, shakes hands with Sir George Edwards at the contract signing

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

Road v. Air Safety

THE attempt by Mr A. H. Crawshaw (Correspondence, March 16) to show that it is safer on the roads is based on two incorrect assumptions. The ICAO statistic "fatal accidents per 100,000hr" is *not* based on *passenger* hours, but on *flying* hours. Furthermore, I pointed out in my article that ". . . this index . . . has a serious deficiency in that accidents in which, say, one person is killed, do not affect the index any more than accidents in which 50 or 100 people lose their lives."

I would have thought Mr Crawshaw would have realized from this that it is not possible to calculate the number of passengers killed, as he has attempted to do.

London W7 ALAN E. SMITH

The Larkin Lascondor

REFERRING to Mr Ward's letter about the de Havilland Australia DHA-3 Drover being the *second* Australian airliner (*Flight*, March 16), I am curious to know what happened to the 1930 Larkin Lascondor seven-seater.

The Lascondor (like the 1929 Lascoter) was a high-wing monoplane, with three 150 h.p. Armstrong-Siddeley Mongoose radials. Incidentally, the Lascoter claims to be the first Australian metal-framed aeroplane.

Birmingham 14 MAURICE AUSTIN

The Space Race

I NOTE that Don Adams' stimulating article on "The Space Race" [March 16] was prefaced by editorial emphasis that his views were "not necessarily those of *Flight*." The inconsistency of the article justifies the preface and, moreover, tends to undermine the reader's faith in American space achievements when compared with those of Russia.

The basic presumption that "the key to success in space" is a reliable booster is correct, for without a booster space research is impossible. This must be the first bridge to be crossed. The next step is to develop high-quality instruments for recording flight data. Lastly, an efficient and adequate telemetry and receiving system must be developed. But maximum effort in developing each section must be dovetailed, which is possible because of the length of time and man-hours needed for each section, so that the final result is a completely efficient unit. However, the second and third stages, despite their efficiency or otherwise, may not be fully exploited until the first bridge has been crossed. Therefore superiority in the latter fields does not mean superiority in the race. Thus, in a comparative analysis, emphasis must be placed, for the present, on the booster stage.

It seems that Russia's booster is more than twice as powerful as its American counterpart, the Atlas. This means that Russia could extract more data from her larger payloads. But, the Americans tell us, impartial observers believe that the US is able to extract more information from a given weight of payload. If this is correct, the logical argument is for Russia to develop her own equally efficient instruments. However, such development, compared with the man-hours necessary to develop a large booster (such as Saturn) requires relatively little effort and time. In other words, in a relatively short period Russia could gain equality with America in the field of instruments, and meanwhile has a large time-lead (at least until Saturn is ready for service) in booster capacity. In addition, Mr Adams conceded that the Russian booster was very reliable, though somewhat inefficient. And, since Saturn has not yet been proved at all, there is considerable room to doubt its reliability. Moreover, going by the record of the Vanguard booster, there seems no reason to assume that the completely new Saturn will be immediately reliable. Incidentally, no account has been taken of inter-service and civil-military rivalry, which is an obvious potentially delaying factor.

Thus the fact that "with the present American lead in airborne electronics the United States would far outstrip the Soviets if both had boosters of comparable size" means very little until America has a booster of equivalent power. Such a statement merely clouds over the basic issue.

I am doubtful of Mr Adams' statement that "the Russians may, of course, simply be withholding the information" about their successful satellites and probes. He does not say why such behaviour would be pointless. In fact, there is a good argument in favour of such action. If the Russians are able to get significant information as a result of their superiority, to publish such information would merely cover up the Americans' inferiority. America would thus be able to take advantage of the greater Russian facilities.

Another irregular statement was that to maintain their popular (and maybe scientific) superiority the Russians must either "build a still larger booster, at least of Nova size, or they must make a determined effort to close the electronics gap." It will be some years before the Americans have a usable equivalent of the Russian booster now in service. This time-lead would seem to provide ample opportunity for the Russians to do both, assuming both are not already in the process of evolution, before America could catch up with present-day Russian standards, and the Russians would still have the superiority if they did develop a Nova-type rocket.

If the foregoing arguments are correct, and there is no proved evidence to contradict them, the inevitable conclusion is that Russia has, and will have, a big lead in this scientific field (which, if I may side-track, is not a state of the art but a state of science). In fact, there is quite some evidence to support my conclusion. From this unfortunate (from the Western viewpoint) position there appears to me only one practical answer. One period of booster development must be jumped. For example, instead of continuing with chemical rockets, maximum effort should be put into nuclear and ion propulsion. This does not contradict my previous argument for not crossing the second bridge before the first, because this only applies to the various sections in the whole field of developing a worthwhile space research instrument. Indeed my previous argument relies upon the development of a reliable and powerful booster before, or at least not after, maximum effort is put into developing instruments and telemetry.

Thus, assuming the Russians have a fairly considerable lead in the space race, and there is a strong case supported by proved evidence to back up this assumption, it seems that America must jump a step in the development of boosters if, in the foreseeable future, she is to show the world that democracy can produce just as good results as dictatorship.

Bromley, Kent CHARLES G. S. SMITH

Stapleford Aerodrome

IN the course of his article on the Aircoupe aircraft in the March 10 issue of *Flight*, your contributor Mark Lambert makes some very scathing remarks about the aerodrome at Stapleford.

Whilst I agree that the surface of our field at that time was not all we would have wished it to be, may I point out to Mr Lambert that we have been subjected to an appallingly wet winter, during which our field was never shut down, although many others in the area were. The "appalling turf surface" and "vicious potholes" to which he objects are the results of the aforementioned conditions.

I would finally like to make the point that the article was supposed to be a report on an air-test and not on the airfield from which it was carried out.

Romford, Essex M. BERG,
Manager, Herts and Essex Aero Club

[The references to surface conditions at Stapleford Tawney in Mark Lambert's article were intended as something of a compliment to the Aircoupe and certainly not as scathing criticism of the airfield, which has a better record than many grass airfields in the London area. We believe that an "air test" of an aircraft legitimately includes comment on ground-handling characteristics.—Ed.]

FORTHCOMING EVENTS

Apr	5	Kronfeld Club: "Air Touring, Including the Sahara Rally," by John Dykes.
Apr	10	RAeS Historical Group: Discussion Evening.
Apr	10-11	Loughborough College of Technology: Symposium on "Applications of Analogue Computers."
Apr	11	RAeS: "Direct Electrical Power Generation by Thermal and Chemical Means, "by Prof M. W. Thring.
Apr	11	Guild of Air Pilots and Air Navigators: Annual Banquet.
Apr	12	RAeS Graduates' and Students' Section: "Man-powered Flight—Progress to Date," by H. B. Irving.
Apr	12	Kronfeld Club: "Pilcher, the Pioneer of British Aviation," by Lord Brabazon.
Apr	12	Society of Environmental Engineers: Discussion on "Climatic and High-vacuum Environmental Test Chambers."
Apr	19	RAeS Agricultural Aviation Group: "A Review of Current Developments in Agricultural Aviation," by Dr W. E. Ripper.
Apr	20	RAeS Astronautics and Guided Flight Section: Symposium on Air Traffic Control.
Apr	25	RAeS: "On the Origin, Structure and Growth of Vortex Separations," by E. C. Maskell.
Apr	26	Royal Air Force Anniversary Concert, Royal Festival Hall, London.

RAeS Branch Fixtures (to Apr 6): Apr 5, *Southend*, a.g.m. and Film Show; *Swindon*, "An Introduction to Aircraft Materials," by A. Black. Apr 6, *Glasgow* (Graduates' and Students' Section), a.g.m., and Lecturettes by members; *Isle of Wight*, "Modern Trends in Passenger Ship Design," by J. West.

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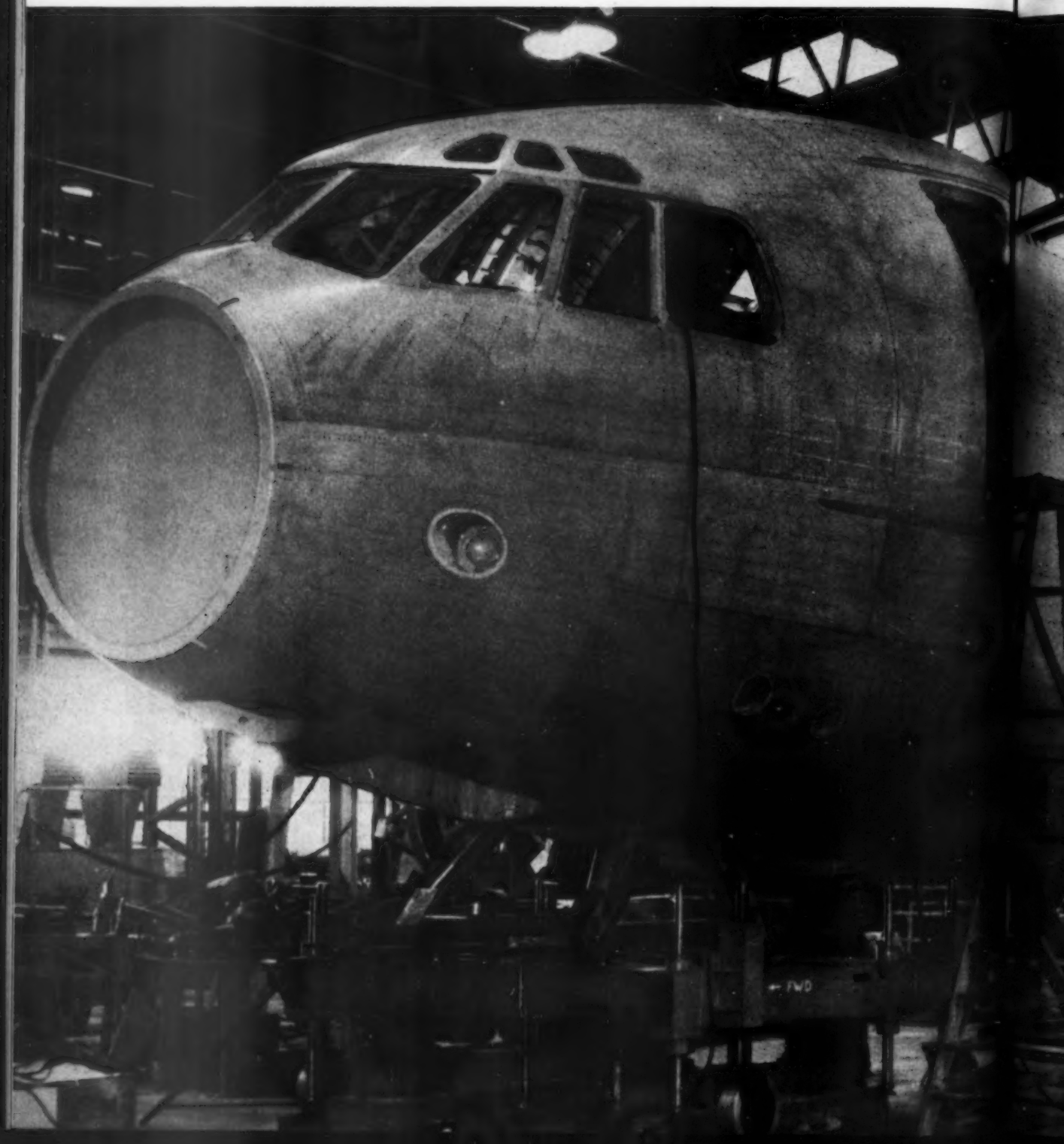

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Sport and Business

OVERALL GROUNDSPEED achieved by Max Conrad in his round-the-world record flight in a Piper Aztec, briefly reported in our March 16 issue, was 123.2 m.p.h. based on total elapsed time. Of the total elapsed time (eight days, 18 hours and 36 minutes), 160hr 34min was spent in flight and 50hr 2min on the ground. The green-and-yellow Aztec N4544P, named *New Frontiers* made 13 stops during the 25,946-mile flight. It was a stock aircraft purchased by Conrad for his personal use about one year ago, and was powered by two 250 h.p. Lycomings which performed well throughout the entire flight.

This must rank as Conrad's greatest flight. Its longest leg was from Bombay to Nairobi, when the Aztec was airborne for no less than 17hr 19min. Three new records were set up: world records for piston-powered aircraft and for Class C-1d aircraft (1,750-3,000kg), and the US national record for speed around the world.

Conrad was accompanied on the flight by Richard Jennings, who was acting as official observer on behalf of the National Aeronautic Association. With a total fuel load of 432 gal carried in standard wing tanks and two extra cabin tanks, the aircraft weighed 6,160lb on take-off from Miami on February 27—1,360lb more than the Aztec's normal gross weight of 4,800lb. Flying at 1,000ft over the Gulf of Mexico, the Aztec kept in hourly radio contact with Miami and New Orleans, and then climbed to 5,000ft over Texas in turbulence which proved as rough as any experienced throughout the entire flight. The transcontinental flight to Long Beach, California, took 14hr 50min.

Refuelling stops at Honolulu and Wake Island were routine and easy, and at Wake it was decided to split the planned Wake - Manila leg into two parts because of strong forecast headwinds. Guam was chosen as the intermediate stop; in the course of a turbulent 8½hr flight, the lead weights on the trailing antenna of the Sunair high-frequency radio were lost. Only a brief delay was experienced at Guam, however, with the help of the Navy and Pan American who co-operated to repair the antenna. Manila and Singapore were the next stops. Only 18min after take-off from Singapore, however, Conrad's Aztec was back on the ramp at Singapore International Airport. The reason was spark-plug fouling caused by the 140-octane fuel which had been supplied at Wake and Guam. The plugs were replaced and the Aztec was airborne again after a delay of only 43min.

Three very long stages followed: 15hr 51min to Bombay, 17hr 19min to Nairobi, and 15hr 47min to Lagos. During the leg from Lagos to Dakar Conrad suffered from hallucinations in a fever attack following an infected injury to his left leg. After four hours, when the daytime tropical heat had died down, the fever passed and Conrad was fit again on arrival in Dakar.

The South American continent was not included in the original itinerary planned for the record attempt and no South American radio facilities charts had been included, therefore, in the comprehensive round-the-world manual prepared for Conrad by Jeppesen and Co. When a blown fuse rendered the Aztec's long-range radio inoperative midway between Dakar and Trinidad, Conrad headed for the nearest landfall, on the South American coast. After spotting the mouth of the Amazon river, the pilot followed the coastline westwards and landed at a primitive jungle airstrip at the town of Amapa in Brazil.

The natives who greeted the aircraft were friendly, but in politest Portuguese informed Conrad and Jennings that they would not be allowed to take off because they had no Brazilian clearance papers. A telegram to the US Consul at Belem solved this problem. Next it was learned that the only petrol at Amapa belonged to the Brazilian Air Force and was not available on any terms. Eventually this dilemma was resolved when a local official who had given the two men food and a bed for the night decided to give them a gift of one 55gal drum of fuel. Conrad was able to take off after an interlude of 18hr 17min on Brazilian soil and flew to Atkinson Field, British Guiana, to take on more fuel.

Max Conrad (right) is congratulated by William T. Piper, president of Piper Aircraft Corp, at Miami Airport on March 8 after the record-breaking round-the-world flight described on this page. Richard Jennings (centre) accompanied Conrad as official observer

From Atkinson the Aztec flew on to Port of Spain, Trinidad, refuelled for the last time and took off for Miami. At Miami Airport on March 8 the two men were greeted by a crowd of well-wishers (despite the 3 a.m. local time) led by Mr William T. Piper, president of Piper Aircraft Corp.

Radio equipment aboard the Aztec consisted of an ARC automatic radio direction finder, Collins VHF and VOR navigation equipment, a Sunair multi-channel HF long-range transmitter/receiver, and a Piper AutoNav radio direction finder. The Aztec was equipped with Goodrich de-icing boots on wing leading edges and tail surfaces, and propeller de-icing systems. Stowed in the cabin was a 25lb survival kit which included a lightweight Navy URC-4 VHF transmitter and receiver.

The log for the entire flight is as follows:—

Miami - Long Beach	2,326.1 miles	14hr 50min
Long Beach - Honolulu ..	2,568.1 ,,	14hr 52min
Honolulu - Wake	2,300.5 ,,	13hr 55min
Wake - Guam	1,501.8 ,,	8hr 31min
Guam - Manila	1,597.2 ,,	9hr 10min
Manila - Singapore	1,480 ,,	8hr 40min
Singapore - Bombay	2,432.7 ,,	15hr 51min
Bombay - Nairobi	2,821.4 ,,	17hr 19min
Nairobi - Lagos	2,382.2 ,,	15hr 47min
Lagos - Dakar	1,522.9 ,,	9hr 19min
Dakar - Amapa	2,439.7 ,,	16hr 46min
Amapa - Atkinson	595.6 ,,	3hr 50min
Atkinson - Port of Spain ..	352.9 ,,	2hr 10min
Port of Spain - Miami	1,625.2 ,,	9hr 34min

A GRUMMAN GULFSTREAM arrived at London Airport on March 21 to begin a three-month demonstration tour of Britain, Europe, the Middle East and Africa. Atlantic Aviation Corporation are European distributors for the type, and are represented in this country by G. and M. Air Interests Ltd. Two Gulfstreams have been delivered in Europe to date; one to Mr Stavros Niarchos and one to the Italian Fiat company. Demonstration flights in this country are taking place until April 3, when the aircraft is due to leave for Germany. The Gulfstream will be among the aircraft participating in the Paris Show in May.

ILLUSTRATED BELOW is the prototype of the Bolkow F.207, latest development of the well-known Bolkow-Klemm Kl107. The name Klemm has now been dropped from the designation of the series. The main difference in the production executive version of the 207 will be the use of a Comanche-type cockpit canopy intended further to reduce the cockpit noise level. The new machine is due to appear at the forthcoming Shackleton aviation weekend at Baginton.

THE SEVEN CLUBS AND GROUPS at Biggin Hill Aerodrome are inviting members of other clubs to participate in a breakfast patrol at Biggin on April 16. The defended zone will be between radii of one mile and four miles from the aerodrome, from 1,000 to 2,000ft above aerodrome level, and the time of the exercise will be from 9 a.m. to 9.30 a.m. If the weather is unsuitable the patrol will be postponed to the followed Sunday, April 23. Telephone number in case of doubt is Biggin Hill 2112.

GLIDER-TOWING performance achieved by the Tiger Club's Archbishop Tiger G-ANZZ from Redhill over the March 18-19 weekend included taking a Slingsby Eagle two-seater to 2,000ft

The attractive Bolkow F.207, the prototype of which is here illustrated, will make its British debut at the Shackleton aviation weekend at Baginton on April 28-30 (see news item on this page)

Sport and Business . . .

in 4min 10sec, and a Skylark to 2,000ft in 2min 20sec. The gliders belong to the Imperial College Gliding Club. Also reported on the same occasion was a period of aero-towing during which the tug was inverted.

FOREIGN TOURING organized this year by the Tiger Club includes the following trips: April 1-2, Berck Aero Club rally; April 29-30, Turbulent tour to Berck and Beauvais; June 18, Sunday lunch outing to Berck; and August 12-20, foreign tour including the Pyrenees. On May 13-14 there will be a Tiger Club barbecue at Redhill Aerodrome to which foreign club-members will be invited.

THE FUTURE of the Governor-General's Cup Air Race in South Africa now appears dubious in view of the Union's forthcoming change to republic status. The organizers of the 1961 race, mostly loyal monarchists (writes a correspondent), have decided that if this year's race is to be the last it shall certainly be the best. The date chosen is May 26-27—the last weekend before the republic comes into being.

On past occasions the race has been very well organized. Handicapping has been so accurate that, after a thousand-mile flight, ten aircraft have reached the finishing line in as many minutes and £1,400 in prize money has been decided in a few seconds. Aircraft are timed individually at maximum throttle over a ten-mile course on the day before the race, and have their take-off times set accordingly. After the first day's run the handicapping is adjusted, and the last 500 miles or so provides the real competition.

Competing aircraft must be propeller-driven, must have a still-air range of 450 miles, and must have a maximum speed of over 100 m.p.h. Most of the machines are American and such names as Cessna, Piper and Beech are as well-known in South Africa as in other countries. The British contingent usually includes an Auster and a Tiger Moth, while hotted-up "specials" are popular but so unreliable that they have not met with much success. Entries are fairly evenly spread between all classes of aircraft from executive to agricultural machines, and club trainers to converted fighters.

The course, 1,175 miles long and passing through all four provinces, is divided into two stages of 625 miles on the first day and 550 on the second. Refuelling and check points are designated, and faulty navigation can lose a lot of time. Most successful entrants in the past have carried a navigator (there is no limit on the number of passengers or crew). The route has required much detailed planning because it includes few landmarks other than the check points and, at the same time, has a good sprinkling of airports to act as diversions—a compromise which is not easy to arrange. A further factor in the selection of this year's route has been the decision to enable clubs in country districts to play a greater part in the planning than in the past.

Is this a chance for Rover to prove their light turboprop in the Currie Wot? Could Beagle make a startling début by winning the race with their first prototype? Although this may be rather hopeful, there is certainly an expanding market for light aircraft in South Africa and a race of this kind could provide valuable publicity for any company hoping to tap this market. Prize money is excellent by African standards—£700, £400, £200 and £100 for the first four places on an entry fee of only £10.

The chairman of the Durban Wings Club, Mr Graham Wulff, who is also a member of the executive of the Aero Club of South Africa, has promised to assist overseas competitors in every possible way. Enquiries concerning the race should be addressed to the Aero Club of South Africa, Box 2312, Johannesburg.

Route for this year's Governor-General's Cup Air Race, organized by the Aero Club of South Africa and described in an accompanying news item

A POPULAR EVENT in the club calendar since 1954 has been the international air rally held by the Channel Islands Aero Club at Jersey Airport. This year's event is being held from Friday, May 5, to Sunday, May 7: a charge of £6 6s per person is being made (covering all accommodation, meals, entertainment, transport and airport dues from arrival to departure). Entry forms should be returned to Channel Islands Aero Club (Jersey), c/o L. W. Ross-Gower, 27 Hill Street, St Helier, Jersey, not later than April 25. The RAF are providing an escort for flights from the United Kingdom to Jersey. There will be prizes for sealed-time arrival, a *concours d'elegance* and a general airmanship competition. The CI Aero Club has nearly 320 members; about 40 are flying or learning to fly. Last year, the rally drew some 60 aircraft from points all over the Continent.

A RECORD SHIPMENT of 37 light aircraft has been made from the United States to Australia. The aircraft are all Cessnas, and the shipment was made to Rex Aviation Pty Ld at Bankstown, NSW, the Cessna distributor for Australia and New Guinea.

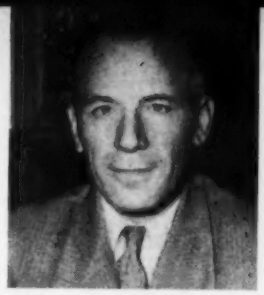
STATISTICS for 1960 in the annual report of the chairman of the British Gliding Association last month included the following:—

A total of 24,400 hours' flying had been reported by the clubs, from 164,997 launches. Compared with the 1959 figures, this showed a decrease of 2,976 hours and an increase of 7,457 launches. There had been 4,749 pilots flying during the year (an increase of 463), in 337 gliders—which included 74 two-seaters and 90 privately owned aircraft. A total of 38,032 cross-country miles had been flown. Gliding holiday courses during the year totalled 186 and were attended by 1,687 pupils. The numbers of gliding certificates issued, which exceeded those for 1959 in each category, were: 613 As, 617 Bs, 388 Cs, 99 Silver Cs and 17 Gold Cs.

The attractive two-seater formerly known as the Morrisey 2150 is now going into production as the Shinn 2150A, a product of Shinn Engineering Inc of Santa Ana, California. Improvements over the original version are claimed, and production should get under way next month. Cruising speed is 135 m.p.h. on the 150 h.p. Lycoming engine, and the basic price is quoted as $8,950

Air Transport and V/STOL

BREGUET'S GENERAL MANAGER DELIVERS THE 14th BLÉRIOT LECTURE



General Henri Ziegler

THE 14th Louis Blériot Lecture was delivered in London on March 23 by General Henri Ziegler, general manager of the Breguet company. His subject was *The Development of Short-range Air Transport Through the Use of V/STOL Aircraft.*

The first part of General Ziegler's paper dealt with criteria for the development of short-range air transport. Under the heading "Flexibility of Operation" he said:

"The operation on a somewhat extensive scale of short-haul traffic requires the establishment of an overall network broken down into a large number of loading points in order to ensure the appropriate service. Surveys recently conducted have demonstrated that a short-range domestic airline can serve communities within 60 statute miles radius around each airfield. This figure, actually, must be reduced if a convenient railway station is available in the vicinity. Thus a large number of intermediate stops are necessary for the type of service expected from the airlines. This extension of the number of small airfields for intermediate stops will be possible only if the required ground facilities are kept to a minimum and are as simple and as inexpensive as possible.

"In the European countries there exists a large number of landing grounds for light aeroplanes which could be opened to commercial traffic requiring grass strips of some 2,000ft only. For example, in France there are only some ten major airports available for normal scheduled transoceanic or transcontinental flights such as those operated by the Boeing 707 or DC-8. There are some 20 additional airports large enough for the Viscount class aeroplanes, but there are more than 400 airfields able to cope with V/STOL.

Islands and Mountains

"In another area of application, the V/STOL transport can serve islands where it is not possible to build large runways, because of the available space, while air service is a first necessity and a public service. This approach could solve the traffic problems of Northern Scotland or of the islands in the Pacific. Finally, the V/STOL transport can open to air traffic many new areas in the mountains. . .

"STOL capability, and eventually hovering capability, seem to be essential to ensure proper safety of operation."

General Ziegler went on to consider the various classes of VTOL and STOL aircraft—conventional machines with low wing-loadings, aircraft with boundary-layer control, convertible types, and those with jet lift. He concluded this part of his paper: ". . . we think, in the present state of the art, that the propeller convertible STOL aeroplane gives a satisfactory answer to the proposed service. These conclusions will probably be altered in a few years because of further technical developments; but I think that a first generation of propeller-driven STOL transport can give a spectacular impulse to short-range air traffic."

The third section of his paper dealt with French experience, particularly with the deflected-slipstream transport aircraft as represented by the Breguet "94" family. Of particular interest were his remarks on safety. He thought that Breguet had devoted most effort to achieve a safety level even higher than for conventional aircraft. General Ziegler said: "It is for this purpose that the mechanical interconnection of the engines and propellers has been prescribed. The advantages of this system are manifold: (1) In case of engine failure the aircraft remains symmetrical, so that it is not submitted to the limitations of the minimum control speed. (2) With a four-engined aircraft, if one engine fails the power of the remaining three units is distributed among the four remaining propellers. The propulsion efficiency is somewhat improved and even though the aircraft is losing 25 per cent of its power, it actually loses only 17 per cent of the slipsteam, that is 17 per cent of the thrust and induced lift. With the interconnection shaft, the four-engined aircraft becomes a "pseudo" six-engine machine.

"We have indicated the system in which a large power is maintained on the engines, while a heavy induced drag is built up by reducing the pitch of the outboard propellers. It so happens that this configuration is extremely favourable from a safety point of view, in the case of a baulked landing. If, in this configuration, the pilot wants to fly round again, he can do so immediately by re-equalizing the pitches of the propellers without changing the power. This gives almost immediately a comfortable rate of climb which can again be increased by partially retracting the flaps (which does not cause any decrease in lift) and by pushing forward the throttle.

"Of course, many precautions have been prescribed to avoid asymmetry on the flaps or on the propellers. I will not detail these systems, which are conventional, but I would like to comment on devices specified to overcome failure of the propeller pitch control or of the connecting shaft itself. It is to be emphasized first that the case of a blade failure is highly improbable, since such failure occurs when the propeller is over-speeding and over-speed is impossible with the interconnecting shaft."

The lecturer showed how the free-wheels and clutches safely overcame any type of failure of the gearboxes or of the shaft system. He went on: "In addition, in case of failure of the propeller pitch control, the blades of the corresponding propeller are automatically locked. Experience has shown that the reserve of differential pitch action on the symmetrical propeller is sufficient to handle the aeroplane safely.

"The studies of these safety systems have been very carefully evaluated in co-operation with European and American authorities, in order to work out the certification rules for aircraft of this type. I would like to take this opportunity of thanking them all for their assistance and their interest."

Discussing problems of operation General Ziegler said: ". . . this aircraft is easy and safe to handle, if not quite conventional. I think, however, that a fundamental characteristic of the STOL type of aircraft is that of landing accuracy.

"Société Breguet does not intend to develop the STOL transport as an aeroplane as such, but to develop a certain number of auxiliary means which will make it a "transportation system" in the same sense as one currently thinks of a "weapon system." This is because this family of aircraft is not intended to operate from existing airports, but from almost any field. It must be mentioned at this point that the structure and landing gear are designed to withstand rough-ground operation. In co-operation with the European electronic industry, Société Breguet is developing simplified but accurate landing aids which should require reasonably small and inexpensive airborne equipment and a minimum ground installation. The aircraft will "haul" itself with a good accuracy and should achieve on small fields a reliability of service higher than is currently being obtained on the heavily equipped runways.

"This is the family of aircraft to which Société Breguet is devoting much effort. The 941 is now being built in our prototype shops and should fly in a few months."

Public Unawareness

"As speed has increased, the number of runways able to receive the new aircraft has decreased because of the tremendous investments necessary to open the required facilities. The air-travelling public, therefore, has been limited to people living in major cities or to those travellers who could come to those major cities by ground transportation means.

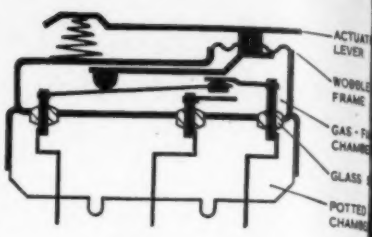
"But enormous short-distance traffic is initiated everywhere, not only in big urban areas. It may be stated that, for the present time, an overwhelming majority of the public is quite unaware of the advantages of air transportation. The new techniques in the field of STOL and VTOL aircraft are about to give a practical, safe and economical answer to this need for fast local traffic. There is, therefore, an enormous potential market for the transport aircraft of tomorrow.

"Of course, procedures for traffic control to ensure safe and reliable service in all-weather conditions must be established and enforced. The corresponding regulations should be prepared without delay to answer the growing demand. It must be emphasized, however, that similar problems were involved in launching jet traffic on a large scale and those problems have been adequately solved.

"I think, therefore, that I am not making an over-statement in saying that we are going to see, in the near future, a real revolution which will change, not only the traffic distribution of airlines, but also the economy of the world and even the political situation of many countries. This new tool will open to normal economic life many countries having possibilities, but handicapped in their development by the lack of means of transport. I should mention also that this new equipment, in its military applications, will also entail radical changes in strategical and tactical concepts, since mobility through a flexible and fast air transport system will be largely increased, thus solving most of the logistic problems.

"Continuous efforts must still be devoted to this new family of aircraft, but we can be assured, from now on, that the success of this enterprise is within our reach."

At far left is a Vanguard main undercarriage leg, near the top of which is a box containing four Honeywell micro-switches. Left, flap-protection switch (visible near centre of picture). Right, a Honeywell Type HS hermetically sealed switch in diagrammatic section (see text below)



The Industry

MICROSWITCHES ON THE VANGUARD

THE operation of a large modern airliner involves the simultaneous control of so many actions that the flight crew could neither think nor act quickly enough to handle all individually. Many functions are therefore left to the care of automatic devices, ranging from complex instruments like autopilots and navigational aids to apparently simple things like electric switches which carry out essential actions at the correct time and in the correct sequence.

The description "apparently simple" is used advisedly, because aircraft requirements make the design of switches a much more difficult matter than designing an industrial control device. Airborne switches have to be as small as possible, yet carry a heavy electrical load; they must have a very long operational life without the need for servicing; they must work in difficult and widely varying environments; and, most important of all, they must be absolutely dependable.

Specially developed switches are now available to meet these requirements. As an example of the reliance which is placed in them, the Vickers-Armstrongs Vanguard uses no fewer than 70 microswitches of various types, produced by Honeywell Controls Ltd, of Greenford, Middlesex. This follows experience on a smaller scale with the Viscount, in which the dependability of the switches has been amply proved.

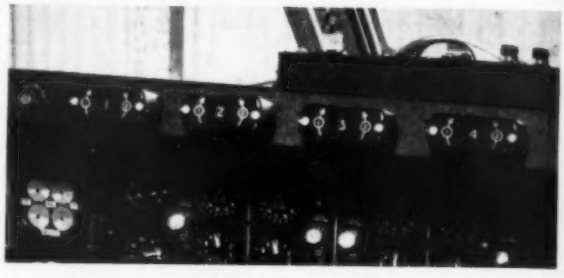
Problems of environment have been solved by the Type HS series of switches, in which the contacts are contained within a hermetically sealed chamber, filled with inert gas (see diagram above). The leads enter this chamber through glass-to-metal seals, which are further protected by a second chamber in which the leads are potted in epoxy resin. Operation of the contacts by the actuating lever is through a brazed-in metal diaphragm.

This type of switch is used on the Vanguard undercarriage. Four are mounted in the box at the top of each main leg, where they are operated by the rod connected to the knuckle at the bottom and actuated by the weight of the aircraft. The chassis switches close a relay circuit which variously reduces the de-icing current to a value which will not cause overheating when the aircraft is on the ground; prevents accidental retraction of the undercarriage; ensures that engine ignition cannot be inadvertently selected "on"; and isolates the stall-warning device and the heated element for the ice detector.

Similar switches in the three wheel-wells provide cockpit indication of undercarriage up- and down-lock, and ensure that the nose landing light is switched off when the undercarriage is retracted. All the undercarriage switches have to operate in the very worst conditions. They must work without fail at very high altitudes and very low temperatures; successive landings and take-offs may expose them, within the space of an hour or two, to a blast of sand-laden tropical air and an icy spray of corrosive water from a salt-treated frozen runway.

Although the weight of each complete switch is only 1.5oz, the d.c. rating is 24A with a purely resistive load, and 10A with an inductive load. An even smaller hermetically sealed switch, working under conditions only slightly less arduous than the undercarriage switches, is illustrated above. Seven of these Type EN switches are fitted to the flap mechanism and come into operation should part of it fail. They trigger electrical locks which prevent runaway of the flap and operate a warning lamp in the cockpit.

Perhaps the most important of all the microswitches in the Vanguard are those concerned with engine-fire procedure. Four handles at the top of the instrument panel each carry out for the pilot the complete emergency sequence of operations for one engine. Four switches are built into each handle. When a handle is pulled, the propeller is feathered, low-pressure fuel is shut off, and the hydraulic shut-off valve is closed; an engine-bay fire-extinguisher is operated when the handle is turned anti-clockwise. Should the fire not be extinguished at the first attempt, a clockwise twist of the handle brings in a second extinguisher. This simplification not only ensures that all vital operations are carried out in the correct sequence, but allows the pilot time to concentrate on trimming his aircraft to the new situation and, if necessary, thinking out the next move. The microswitches in this case are of the standard plastic-cased V3 type which, although mounted in a well-protected position, are satisfactory for use at temperatures up to 180°F. A high-temperature version, with an asbesto-filled phenolic case, and suitable for temperatures up to 250°F, is also available.



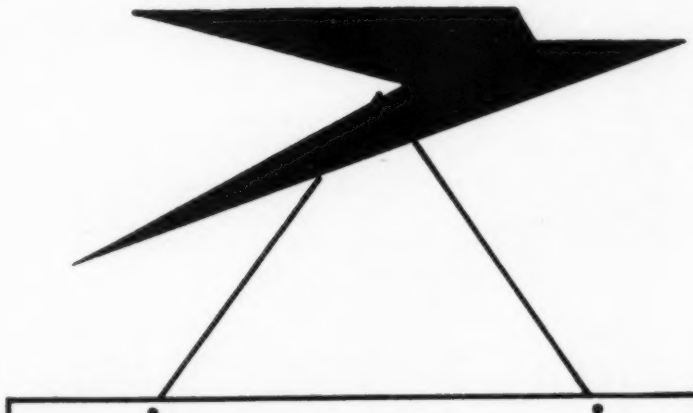
Fire emergency switches at the top of the instrument panel

For really high temperatures, the Type HT microswitch is mounted in a ceramic and Monel case, which allows an operating temperature range of from −50°F to 1,000°F. Fitted to the engine-mounted cabin-air blowers, devices of this type act as limit switches on the butterfly valves which are co-ordinated with the cool air supply from the ducts.

Other applications of Honeywell microswitches on the Vanguard include those concerned with equalization of cabin and external pressure before cabin doors can be opened; control of local lighting in the under-wing refuelling bays and other areas when the access doors are opened and closed; selection of emergency flap and undercarriage operation; and control of warning lights to indicate hydraulic and other service failures.

In addition to those described above, which apply to the BEA Vanguards, many more switches of the same kind have been specified for the Vanguards supplied to TCA. Almost all of the normal toggle switches are by Honeywell, as is a special array of switches mounted in the control cabin roof and operated in one movement by a rotary cam, to act as power supply master-switches.

This switch in the engine bay, controlling the Godfrey control valve for cabin air, is designed to withstand very high temperatures



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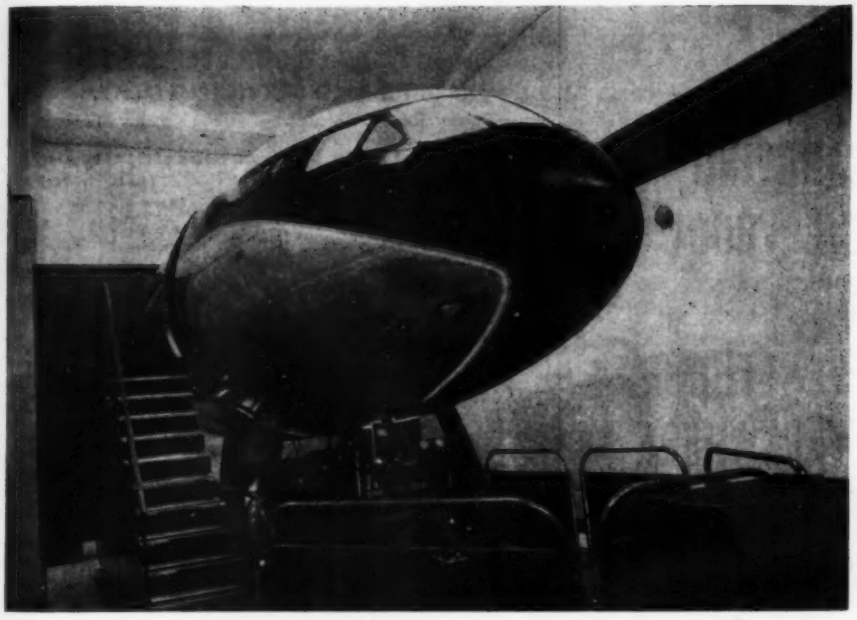

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AIR COMMERCE

Thriving air travel centre though it is, with 50,000 passengers expected in 1961, Derby Airport Burnaston is reaching the end of its useful life. Concrete runways and space for expansion are needed; and in its search for a successor Derby Town Council is making a bid for ex-RAF Castle Donington. The Air Ministry has agreed, but local protests have called for a public inquiry which began on March 22

BEA versus British Railways

TO have to ask the Air Transport Licensing Board to approve a new commodity rate for domestic air freight is rather like asking for the proverbial sledgehammer to crack a nut. At the Board's third public hearing on March 22 more than a whole hour was inconclusively devoted to hearings on BEA's application to introduce special rates for motor car parts on their regular services between Birmingham and Manchester and Edinburgh. In the end the hearing had to be adjourned because the objector, British Railways, wanted more evidence on the need for the new rate.

Clearly the procedure will have to be streamlined; commodity rates are the mainspring of the air freight business and hitherto the airlines have had a free hand in introducing them when and where they judged the domestic market would bear them.

This was the first licensing clash between BEA and British Railways, and the difference between the two forms of transport was manifest in the different approaches of the opposing advocates —Mr Henry Marking, secretary of BEA, and Mr G. H. P. Beames, solicitor acting for British Railways.

Mr Marking made his case, producing figures to show that there was no undercutting of surface rates and noting that objections on the score of wasteful competition would be groundless because the commodities concerned would be flying as fill-up loads on flights that were running anyway. "We are certainly out to compete with British Railways in the carriage of freight," he said, "and we make no secret of that."

Mr Beames, evidently a little taken aback by the informality of the proceedings (he insisted on standing to speak), adopted the mannered judicial approach. "It is an old principle of law," he declared, "that he who asserts must prove." There were, he said, "certain matters on which m'friend has spoken on which he should provide evidence." He deplored this "apparent clash" between BEA and British Railways; it had been said [in that morning's *Daily Mail*] that this was a test of strength between rail and air. But it was nothing of the kind. British Railways were not saying that BEA should never carry anything, but here there was "a very appreciable cut in fares," and it was up to Mr Marking to call evidence. "I do say this and I say it with all sincerity that we are very seriously concerned about this application."

BEA's secretary said respectfully: "It is up to the Board to decide whether it wishes to formalize the proceedings." If he could be allowed to make a personal observation, he had always hoped that "the informality coupled with the impartiality of the old ATAC would be preserved at these hearings."

For the next ten minutes the Board (at full strength except for Mr Harvey) appeared to be at rather a loss. Mr Wilson said he certainly didn't want the Board to become like "certain top-heavy bodies in some other countries," but "rather a novel question had been raised." Sir Friston How had doubts about the usefulness of further evidence; Mr W. P. James remarked that British Railways were ready to answer a case when a case was made—and would BEA object to an opportunity to produce evidence? It was Mr C. Bagnall who brought relief by voicing the thought in everyone's mind: "I am not quite clear *what* evidence."

Mr Marking said he could produce someone from Rover [the motor car firm primarily concerned], but he thought that Mr Beames might regret it. This drew the good-humoured retort: "You wait and see." Mr Marking asked the chairman what sort of evidence the Board wanted, and Mr Wilson thought that perhaps Mr Beames could help the Board on this point. Mr Beames was obviously a little shocked by this "rather novel suggestion," though of course he was only too glad to help. His clients wanted an opportunity to contest evidence on points such as why there was dissatisfaction with existing services; how the new rate was arrived at; that the service would not be wasteful competition; and so on. The hearing was adjourned. The next case, which we hope to review later, provided the first clash between BEA and the independents (BUA and Cunard Eagle).

One wondered whether British Railways, in winning this particular procedural victory, had not actually done their air competitors a service by unwittingly highlighting the sledgehammer-to-crack-a-nut absurdity of the commodity-rates approval procedure itself. Commodity rates apart, it is obvious that the Board will hear many a clash between the two State transport corporations. Quietly and without fuss, BEA is carrying more and more of British Railways' passenger and freight trunk-route traffic. As the recent Select Committee report on British Railways showed, BR seem but dimly aware of the inexorable trend—a trend which no amount of £24,000 executives can reverse.

And though no one doubts the impartiality of the Board, one wonders how impartial it *can* be towards surface-transport objectors like British Railways when its statutory duty is "to further the development of British civil aviation."

J. M. R.

BUSY BRITISH AIRPORTS

IN contrast with airports in the USA, where in 12 months aircraft movements have declined by 4 per cent, traffic at British airports is booming. There were 12 per cent more movements at UK airports in 1960 than there were in 1959, and numbers of passengers handled increased by 28 per cent to more than 10m. Freight also increased by nearly a quarter.

London-area airport movements, which declined between 1958 and 1959, last year slightly increased. This was due almost entirely to another 16,000 aircraft handled at Heathrow and 13,000 at Gatwick, increases at these airports offsetting the loss of traffic at Croydon and Blackbushe. Traffic at Gatwick is now picking up. Last year it increased by over 50 per cent, to make it the third busiest airport in the United Kingdom.

Very heavy traffic continues to be carried by the vehicle-ferry airports of Ferryfield and Southend, although in 1960 Manchester overtook Ferryfield for fourth place in total aircraft handled. Movements at other major airports remained virtually the same as in 1959.

Aircraft movements are, of course, only one measure of airport workload, and may bear little relationship to passengers handled. Nowhere was this better demonstrated last year than at Stansted, where aircraft movements increased by less than 100 but passenger traffic was up by 42,000. In terms of passengers handled this was the greatest increase at any airport in the British Isles. Others which had large increases of passenger throughput were Southend, at which passengers handled rose by 76 per cent to 381,000; Hurn, which, in absorbing passengers formerly handled by Eastleigh, showed an increase of 79 per cent; and Leeds/Bradford, where passengers handled were 78 per cent higher than in the previous year. This was the result of Yorkshire's airport more than doubling its air-transport movements. Total movements, however, actually declined.

The shape of the Comet in the skies of the Middle East is now a familiar one as services operated by MEA, UAA, BOAC and BEA steadily build up. Seen here over Beirut is a Comet 4C of MEA, whose aspirations to form a Pan-Arab airline could lead to new orders from other airline operators in the Middle East

AIR COMMERCE . . .

NORTH-SOUTH TRIES AGAIN

LAST June the ATAC rejected North-South Airlines' application for a Leeds/Bradford-Leavesden daily service, using Herons and Heralds (Leavesden is a de Havilland airfield near Watford, north of London). Having overcome earlier ATAC objections, they have now applied again, for a twice-daily return service. The airline points out that while BKS Air Transport's Leeds/Bradford-London (Heathrow) service connects with onward flights from London, the North-South service will provide a 40min flight to and from Leavesden—45 min from Watford Junction to Euston by rail—for passengers wishing to reach Central London, or the West Riding, without delay. The proposed service will operate morning and evening in both directions at £7 15s return and £4 12s single.

Meanwhile, the BKS service, started in October, continues to make healthy progress through the winter months, averaging about a 60 per cent load factor.

YOU CAN'T GET AWAY FROM IT

A TELEPHONE service for airline passengers has from the beginning of this month been made available by the GPO to callers in Great Britain. Passengers can also telephone to subscribers in the British Isles. If tests are satisfactory, the Post Office would make the service—which is an extension of the existing UK long-range HF radiotelephone service from ships at sea—available to any airline or to any privately owned aircraft.

Only El Al's Britannias are equipped with telephones as yet, but the service they offer has already been put to use. Such facilities are not unique; the American Telephone and Telegraph Company and some European countries operate a comparable service. According to a newspaper report, El Al has found that it takes about ten minutes to call a subscriber on the ground but up to an hour in the reverse direction. The charge depends upon the position of the aircraft. In the zone between 35°W, 35°E, and 35°N, which covers most of Europe and extends about half-way across the Atlantic, the charge is £1 16s for three minutes and 12s for each additional minute. On top of this there is a report charge of 4s. For areas outside this zone, the charge will be £3 for three minutes and £1 for each additional minute, plus a report charge of 6s.

OVERSEAS AVIATION'S EXPANSION PLANS

A SCHEDULED service from London Gatwick to Madeira has been applied for by Overseas Aviation, the third carrier (following Silver City and BEA) to bid for this route. Overseas specify the use of Argonauts at first and later Viscounts, Vanguards or Tridents. This independent has also applied for scheduled services from Birmingham to Geneva, Nice and Salzburg/Rimini, and from Jersey to Rome and Barcelona. The company's interest in the Argosy is also recorded in an application to operate a vehicle ferry and passenger cargo service between Gatwick and Ostend at an initial frequency of eight round trips a day, starting with Bristol 170s.

MORE RANGE FOR THE DC-8

IMPROVEMENTS in payload and range are announced by Douglas for the Pratt & Whitney JT3D-1 turbofan-powered DC-8 Series 50, the first of which flew on December 20 last. The flight-test programme on range, just completed, indicates that the Series 50 should have 23 per cent better range than JT4-powered DC-8s now in service, plus a further 7 per cent range due to the extended leading edge. There should also be an increase in long-range cruising speed.

These figures are considerably better than those anticipated in the official Douglas figures previously published. Maximum still-air

Now based at London Gatwick, Maitland Drewery operate three Viscount 708s purchased from Air France last year. Fitted with 58 seats they are used for inclusive tours and general charter work. The company recently sold its two Vikings to Air Safaris, the sale being handled by H. Clarkson Ltd

range of the JT4-powered DC-8 Series 40 was then given as 5,430 st miles and the range of the Series 50 as 5,930 st miles, an improvement of only 7 per cent. Douglas now say that their calibrated flight-test results mean that the modified-wing Series 50 will have a *full-payload* range of 5,960 st miles with normal reserves. Unmodified aircraft will be able to carry full payload for 5,500 st miles with normal reserves.

Two aircraft have been involved in the test programme; a production aircraft joined in 30 days after the first flight of the JT3D prototype. DC-8 Series 50s are on order for KLM, Iberia and United.

DON'T TRY IT

A OPA's 180° rating, referred to on page 367 of *Flight* last week, has received publicity from an unexpected quarter. The MoA's Aeronautical Information Service at Pinner, which is responsible for re-promulgating overseas aeronautical information circulars, has recently received from the Directorate of Civil Aviation, East Africa, Circular No 4/1961 dealing with non-instrument-rated pilots. "There have been a number of reported incidents of recent months," the preamble runs, "where pilots who have had no instrument-flying training and have not been instrument-rated have got themselves into situations from which they would not have been able to extricate themselves without some knowledge of instrument flying."

The circular takes the unusual form of quoting extensively from an article in *Air Facts of Africa* which "it is hoped may serve as a discouragement to those pilots who are not instrument-rated and . . . also as an encouragement to such pilots to obtain an instrument rating." The article refers to the experiences of the University of Illinois in assessing the capabilities of non-instrument pilots in instrument weather. The moral is clear: it can't be done.

DC-8s AND CONVAIR 880s FOR VIASA

VIASA is a new airline formed at the instigation of the Venezuelan Government to take over international services from Aerovias Venezolanas SA (AVENSA) and Linea Aeropostal Venezolana (LAV). The former Venezuelan overseas carriers will now operate solely domestic services. Many of their personnel have been absorbed by the new operator, which has recently joined IATA. First president of VIASA is Mr R. van den Branden.

Capital of the new company is owned jointly by the Venezuelan Government, which holds 55 per cent of the shares, and the balance is held by private interests, including AVENSA and LAV. KLM has an operational agreement with VIASA, and will train technical, flight and commercial staff. In addition, KLM will operate Atlantic DC-8 services on VIASA's behalf until a DC-8 ordered by the new carrier is delivered. The Venezuelan airline will serve, on a weekly basis, Paris, London and Amsterdam, and Lisbon, Madrid and Rome. Services to London are to start on April 6.

Other VIASA services will connect Caracas with Lima, Peru, and services to New York, Miami and New Orleans are planned. The latter will be operated with two Convair 880-Ms, the second having been ordered recently (see last week's issue).

WERE THE AIRLINES SO MAD?

IN our recent review of Peter Brooks' new book *The Origins of the Modern Airliner* we remarked on the significance of one particular passage. This suggested, in as many words, that the jets are not—in the light of actual operating experience—increasing the cost of air transport.

Now a BEA colleague of Mr Brooks, Mr K. G. Wilkinson of the corporation's engineering department, has written a paper which will further shake the diehard turboprop protagonists—those who have always maintained that, design for design, the turboprop will always offer a lower operating cost. Soon, it seems, these diehards must concede defeat, because it looks as though history is going to show that they were wrong.

"There has been a school of thought," says Mr Wilkinson (whose paper appears in the Hawker Siddeley Technical Journal), "that propeller turbine aircraft could produce cheaper airline fares than the jets, and at one time the most careful and objective analysis seemed to indicate that a margin of some 10 per cent existed in potential seat-mile costs between the two species." The objective analysis to which Mr Wilkinson refers was *The Economics of Speed*, the Brancker memorial lecture presented by Lord Douglas of BEA in 1958. Recent analysis of the *actual* performance of aircraft types, as compared with the generalized Brancker lecture study, seems to indicate, says the author, "that the difference is turning out to be less than expected, even on relatively short hauls."

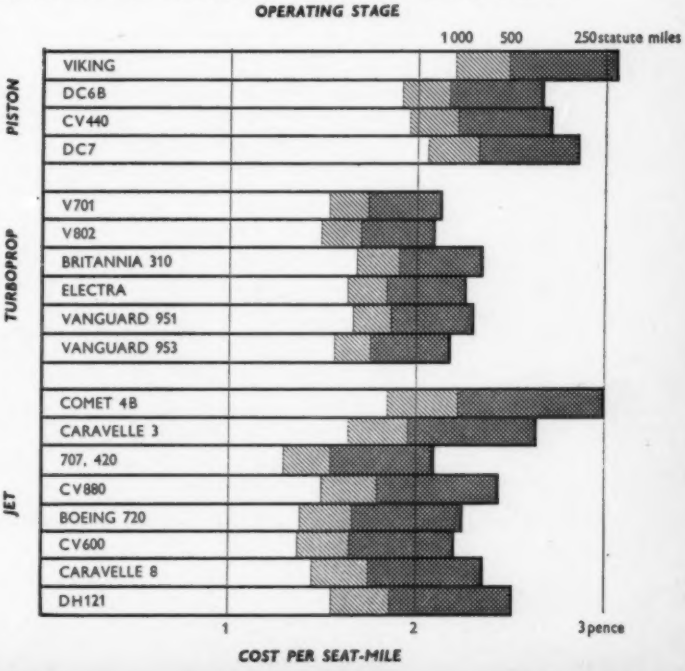
The paper includes the exceptionally interesting picture reproduced below. Of course, BEA's cost formula is not everyone's cup of tea, keyed as it is to an unusual type of route network. Nevertheless, it is revealing for the reader of this paper to compare the aeroplanes that BEA use, will use, or might have used.

The aircraft eligible for the comparison are, jets: Comet 4B, Caravelle 3, Caravelle 8, D.H.121 Trident; turboprops: Viscount 701, Viscount 802, Electra, Vanguard 951, Vanguard 953. The cheapest jet appears to be the Caravelle 8, a project—now cancelled—designed around two Rolls-Royce RB.141/11As. Whether or not the projected turbofan developments of the Caravelle will match the estimates for the Caravelle 8 is a matter for speculation; in the meantime the lowest-cost short-haul jet in this study appears to be the D.H.121. This aircraft is as cheap to operate as the early Vanguard over 500 miles and, at 1¼d per seat-mile, cheaper over 1,000 miles. At this stage length it is even marginally cheaper than the Vanguard 953, though this Vanguard has the edge on cost over the 121 on the shorter stages. The edge is narrow, but it has to be remembered that there is a "technology time-scale" difference of about three years between the two aircraft. The Caravelle 3 is only a few decimal points of a penny more expensive to operate than the D.H.121; this is remarkable for a jet that is in service. The D.H.121 shows a considerable improvement in operating cost over the Comet 4B, which appears to show the highest operating cost of all the jets considered. Surprisingly, the Vanguard is not cheaper to operate than the Viscounts it is replacing on BEA's routes, although of course the estimate is on the basis of Viscounts that have been written down.

Reverting to Mr Wilkinson's text, we are reminded of the Rand Corporation's report presented at the SAE meeting at Los Angeles in 1960. This lent further support to the view that "the modern jet aircraft may provide as cheap air transport (except perhaps on very short hauls) as the turboprop." This was a reversal of the Rand Corporation's findings seven years previously, due to considerable improvements in jet engine performance since that date.

The author recalls the widespread criticism of the jet buying spree, criticisms made on the grounds that the airlines' self-interest

Up on to a 50ft roof at Luton Airport goes this identification beacon, the "crane" being an Agusta Bell 47G of Helicopter Services Ltd. The beacon is part of a £35,000 GEC airfield lighting system being installed by C. Maurice Contractors Ltd, who finished the job last week



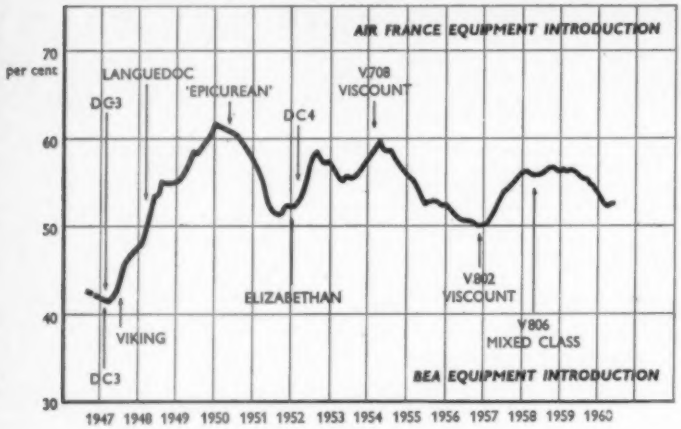
BEA "formula" operating costs for various types are shown here. Assumptions include a 100-seat tourist (34in) configuration, 1,000 st mile design stage, and 1959 price levels for prime cost (see this page)

AIR COMMERCE . . .

was incompatible with sound long-term planning, which had gone by the board. "The matter now seems much less certain," he says, "and it may even be that the airline managements who precipitated the jet age [presumably a reference to Pan American's pioneering big jet order in October 1955] knew what they were about."

This brief summary of Mr Wilkinson's paper is taken out of context; entitled *Airline Fleet Planning*, the general subject is a review of the problems facing airlines who are planning to order new aircraft. The right choice is important, as another illustration—reproduced below—emphasizes.

The competitive effect of introducing new aircraft on a route could not be more sharply highlighted than by this chart, from Mr Wilkinson's paper (see story above), showing London-Paris traffic on a moving annual basis



EUROPEAN FARES UP?

IN Paris on March 23 the European airline members of IATA met to discuss a proposal to increase European air fares. According to *The Financial Times*, which broke this surprise story, the proposed increases range between 2 and 5 per cent, and will apply both to first-class and tourist-class services. It is suggested that the increases should be effective as from April 1.

One of the reasons given for the proposed increases (which would be the first upward adjustment of the European general fare structure since April 1957) is said to be the raising of UK landing fees on April 1. But there must be other reasons why the intra-European operators have decided to get together to see what can be done about their worsening cost level. Though BEA are among those finding it hard to keep costs down, they are thought likely to oppose the increases. BEA's philosophy of cutting fares has not, it is believed, changed; and there is in any case a serious public relations problem—shared by all the airlines, and not only BEA—of suddenly asking passengers who have booked seats this summer for more money.

The European airlines will, if the increases are recommended to governments, undoubtedly emphasize the main reason as being increased UK landing fees. Whether BEA will lend its voice to this remains to be seen; it certainly did not hesitate to reduce its proposed cuts in domestic fares as a consequence of higher landing charges. At any rate, BEA's declared hopes in 1959 of introducing economy-class, no-catering services in Europe now seem further away from realization than ever. These aspirations had to be compromised to an extended off-season promotional fare structure in deference to BEA's European partners; now, for the first time in four years, the corporation is faced with a proposal for general increases.

CONVAIR 990 DELAYS

WING flutter is said to be responsible for delayed deliveries of the Convair 990, which SAS and Swissair were expecting to start receiving this month. It may be recalled that the SAS/Swissair consortium originally ordered the Convair 880—which they could have had from September 1960—but switched to the more advanced and more economic 990 which, it then appeared, would be delivered six months later. Now it is unlikely that the consortium will get its 990s before December 1961. This will mean the loss of summer season business estimated at more than a million dollars.

According to *Aviation Week*, SAS and Swissair officials have been in San Diego discussing with Convair the reason for the delays and the possibility of leasing shorter-range Convair 880s to provide competitive capacity for the summer period.

The trouble is understood to be the onset of wing flutter at about 350kt IAS. It is thought that this will be remedied by shortening the outer engine pylons by a little over 2ft. Another trouble that has come to light is inadequate elevator power at full forward c.g., believed to be caused by turbulence from the inner-wing Kruger leading-edge flaps. According to *Aviation Daily*, certification is not now expected until December 31.

There is a contract for nine 990s between Swissair and Convair; SAS are to lease two of these nine, and are themselves purchasing two more direct from Convair.

MOBILE LOUNGES FOR LONDON?

WHATEVER the new long-haul terminal building at London (Heathrow) central may have in the way of gates and fingers there will certainly be vehicles to carry passengers out to the more distant stands. This was indicated by the Government spokesman, Lord Mills, in the debate in the House of Lords last month on London region air traffic. He referred to "a number of new and interesting designs which were under consideration."

A choice will have to be made between three basic systems: (1) Simple low-level coaches with more seats and better entry and exit facilities than in the passenger buses now employed; (2) vehicles with a fixed floor raised 10ft above the ground and an adjustable ramp to suit the door-sill heights of various aircraft. These would have direct access for trickle-loading from the terminal air-side gallery; (3) vehicles with an elevating floor suitable for loading either from the ground, from the air-side of the terminal, or from the aircraft. It is estimated that these would cost five times as much as special low-level coaches.

Stands near to the terminal will definitely be served by a system of fingers. It seems likely that eventually there may project from the new central terminal a north pier, a south pier and a central one in between. The maximum walking distance from the air-side gallery will be limited to about 1,000ft.

A large number of layouts have now been studied and although the piers have yet to be finalized, a decision may be reached by the end of this month when schemes sent out to all long-haul operators for comment are returned. Plans for a finger-and-gate system for the short-haul terminal are also in an advanced state of preparation. The problem is to find stand accommodation around the central area buildings for 100 aircraft, as proposed by the Millbourn Committee. There are 50 stands at present, and half of the additional stands, it has been announced, will have been completed by the end of the year.

For a number of reasons it seems likely that the system of taxying in and taxying out under an aircraft's own power may have to be abandoned; the turning radius of a big jet makes this expensive on stand space, and power-on departures raise problems of protection from blast. For turn-on parking with the VC10 stand centres would have to be about 340ft—about 100ft more than are current at present.

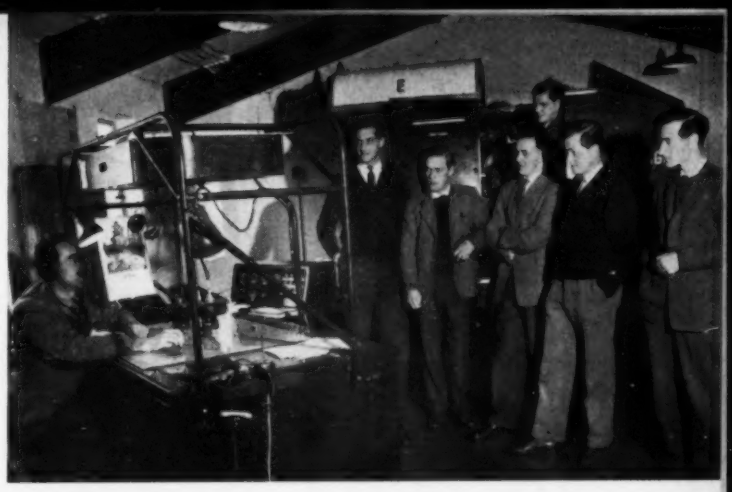
Nose-in parking under power with towing or pushing out for departure—though unpopular with airlines—not only allows a substantial increase in the number of stands that can be sited along a 1,000ft pier, but simplifies taxying guidance and blast screen protection of passengers and buildings. For instance a 3ft screen has been found adequate for the 707, but entirely new problems are raised with the VC10, in which the rear engines are raised some 15ft above ground level. And while low screens afford wing clearance for turning-on parking, it is by no means certain that adequate blast protection for VC10 stands could be provided without a further increase in stand spacing.

To carry the argument further, in perhaps ten years' time the stands for which provision is being made now will have to handle supersonic airliners with a much greater turning radius and probably with very powerful rear engines—thus greatly aggravating the already serious problem of blast.

If nose-in parking is adopted, the MoA will have to decide how elaborate should be the facilities provided at each stand. Should, for example, "aerobridge" loading be provided for both front and rear exits? What arrangements should be made for rear-loaders such as the Caravelle or the Boeing 727? And which airlines will use the distant, vehicle-served stands?

It is these problems which the long-haulers are being asked to consider now. Whatever the outcome of their recommendations, it seems possible that some stands at least will have to be allocated to airlines on a preferential basis, with graded charges for position and the facilities to be provided. Other stands would be available for random use, the most distant carrying the lowest charges.

A. T. P.



Undergoing training to airline standards by Silver City at Ferryfield are a number of young pilots with private and commercial licences. They are the first to be trained under a new scheme to attract pilots for the air ferry and for the airline's passenger services

UNITED AIR RAILWAYS

ONLY a month ago it seemed that the *entente* which has been growing up between the vehicle air-ferry services and British Railways had fallen into decline before it had really begun. When Silver City abandoned the rail link to Ramsgate on the Silver Arrow service between London and Paris, and replaced it with a coach service between London and Lydd, we wrote, "From any point of view rail-air collaboration in Great Britain appears to have taken a backwards step."

Yet with the briefest of notice there started last Monday, March 26, a new service which shows an unusual degree of rail-air collaboration—not only between BR and a vehicle-ferry operator, but with a Continental railway system as well. Participants are the Eastern Region of British Railways, Belgian National Railways and Channel Air Bridge, and the service is marked by the first issue of a combined rail-air ticket valid on the services of three different carriers. It was only 11 months ago that air and rail in Great Britain were first linked on one ticket, for Continental day excursions on combined British Railways Eastern Region and Channel Air Bridge services.

The present service is between London and a dozen places in Belgium, notably Brussels, which is reached in about four and a half hours. Second-class 23-day excursion fare is £9 4s 3d, so that travelling from city-centre to city-centre by rail-air takes about an hour and a half longer than by scheduled air service plus coach-and-train journeys, but is £2 13s less expensive. To understand in full the prospects of the Air Bridge's new rail links, more would need to be known about Silver City's breakaway from the Southern Region's rail service—the reasons for which have not been revealed. All that is certain is that the initiative for this new service has come from Eastern Region and Belgian National Railways, to which the Air Bridge has been glad to lend its support. Negotiations have been in process for nearly three years.

There are to be ten services a day during the summer and five or perhaps six next winter, carrying a total of perhaps 10,000 passengers a year. Inevitably, some of these travellers will be those attracted away from the Southern Region's rail-and-boat services from London to Dover and Ostend, but as considerably more than a million people travelled on this route in 1960, diversion should be very slight.

TRIDENT NO 1 BY OCTOBER

WHEN de Havilland released the first detailed information about the D.H.121 Trident over a year ago, they said that the first aircraft would fly in December 1961 (*Flight*, January 22, 1960). Since then they have allowed very little to be published about the aircraft, preferring to get on with the job, as they did in the case of the Comet 1, with the minimum publicity. Not one "progress picture" has been released during the past year.

In recent months there have been rumours of a kind unusual in the British aircraft industry—to the effect that the 121 is two or three months ahead of schedule. Certainly those who have seen the production line at Hatfield have been pleasantly surprised at the progress that has been made.

Now, in an interview with Frank Beswick recorded in this issue (page 401), Sir Roy Dobson of the Hawker Siddeley Group says that the first 121 will be ready by October. This is two or three months ahead of schedule, and 13 months ahead of the Boeing 727, the first of which is due to fly in November 1962.

WHAT FUTURE FOR "Q.III"?

IT was in 1957 that the North Atlantic IATA airlines first carried more than a million passengers between Europe and North America. It was in the following year, 1958, that the airlines achieved something of greater significance: they carried more passengers than the ships on this route. Now the airlines are carrying more than *twice* the number of sea-going passengers. The following table tells the story:—

Total North Atlantic Air and Sea Passenger Traffic
(figures rounded off)

Year	Sea	Air
1956	1,028,000	835,000
1957	1,038,000	1,023,000
1958	958,000	1,292,000
1959	882,000	1,549,000
1960	869,000	1,919,000

Sources: IATA and Atlantic Passenger Steamship Conference

Air traffic thus overtook sea traffic in 1958, and only two years later was double sea traffic—which has actually declined steadily since 1957.

The Chandos Report recommendations to the Government about the *Queen Mary* replacement were secret, so it is not known how closely these traffic trends were examined, if at all. In the Lords debate on the new Cunarder last November Lord Mills gave the reason for the Government's decision to subsidize the new ship as: "there is something in prestige but that is not the whole story . . . It is true that air transport is going up at a greater rate —a much greater rate—than sea transport, but sea transport is going up, too . . ." Not on Q.III's route, it seems.

BREVITIES

Mr Charles C. Tillinghast has been appointed president of TWA as from April 17. He succeeds Mr Charles S. Thomas, who resigned in July 1960.

Writing in the *Avro 748 Journal*, Mr C. F. Bethwaite, chief development engineer, gives the target date for certification of this aircraft as July 1961.

Southampton Eastleigh is to be sold by the Ministry to Southampton Corporation for a price thought to exceed £200,000. The corporation intends to sell the airport to Mr John Somers, who already owns Panshanger airfield, Herts. On March 20 BEA transferred its operations from Southampton to Hurn Airport.

A rail-air-rail ticket for journeys by three different operators, and available at all British Railways Continental booking offices. See "United Air Railways" above

Swissair is planning to re-engine its three DC-8-30s (Pratt & Whitney JT4A-9s) with turbofans.

Northwest have sued Lockheed for £893,000 damages for "negligence and carelessness in design and manufacture of the Electra."

Mr Reg Ansett has now made a £2m bid for TEAL, the Australian Government's half-share in which is likely to be sold to the NZ Government.

As from April 1 all IATA airlines operating in controlled airspace over Europe, the Middle East, Algeria and Tunisia will fly IFR regardless of the weather. Their pilots will no longer accept VMC clearances.

The Minister of Aviation told the Commons last week that he was doubtful whether BEA's proposal to build its own terminal at London Heathrow Central "would be the most advantageous way of developing the airport in the general interest." He was awaiting the report of a joint BEA/Ministry working party.

The fourth hearing of the Air Transport Licensing Board will take place on Wednesday, April 5, at 10.45 a.m. at the Board's new offices at Therese House, 29-30 Glasshouse Yard, Aldersgate Street, London EC1 (telephone Clerkenwell 8841). Four applications for inclusive tours between Southend and Ostend by Channel Air Bridge and East Anglian, and objections made by Cunard Eagle and British Railways, will be heard.

SERVICE AVIATION

Air Force, Naval and Army Flying News

Air Cdre J. M. N. Pike, AOC Gibraltar (centre), with AVM K. V. Garside, Coastal Command SASO (second from right), in the control tower at RAF North Front during the latter's recent visit to Gibraltar. At left is Mr B. Humphrey-Davies, an assistant Under-Secretary of State for Air; right, Sqn Ldr W. S. Akeroyd, SATCO

Sqn Ldr R. Ramirez, CO of No 208 Sqn, based at Nairobi, Kenya, holding a warrior's shield with which he was presented by Masai tribal chief Simeon Ole Pasha (right), who holds a plaque of the No 208 Sqn badge and is wearing a sash in squadron colours

Queen's ADC

ONE of the most famous Battle of Britain pilots, Gp Capt A. C. Deere, DSO, DFC, has been appointed an aide-de-camp to the Queen. A New Zealander, Gp Capt Deere joined the RAF in 1937. He flew Spitfires with No 54 Sqn and in August 1941 took command of No 602 (City of Glasgow) Sqn, also equipped with Spitfires. Later he commanded No 403 Sqn, RCAF, at North Weald and subsequently the Biggin Hill Wing. He destroyed 21 enemy aircraft. At present Deputy Director of Personnel (Air) (2) at Air Ministry, he described his wartime experiences in an autobiography, *Nine Lives*, published in 1959.

UAS Future

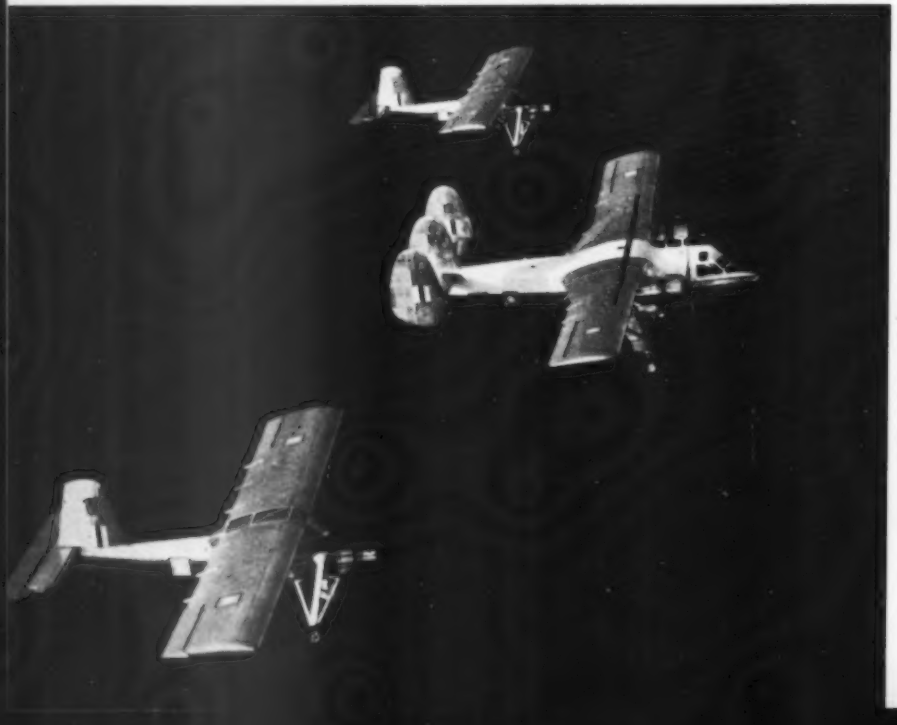
TWO senior officers gave their views on the value and the future of university air squadrons at UAS dinners held in Yorkshire recently. At Leeds the Air Member for Personnel, Air Marshal Sir Arthur McDonald, said that the squadrons' future was being debated and certain people had been given the task of economizing. Until recently the position had been that the majority of UAS members had not gone forward into the Service. The value of the squadrons had therefore been limited. "It is a fact that at the present time we are quite seriously short of officers," said Sir Arthur, "and this is something that is worrying us quite a lot." He said he felt that the 1957 White Paper was responsible for the falling-off in aircrew recruitment. The impression that White Paper had given had been wrong. What was certain was that the number of aircrew required in the next five years would be about 40 per cent greater than what had been required in the last five years.

At Hull the AOC-in-C Bomber Command, Air Chief Marshal Sir Kenneth Cross, said that he had always believed that the intangible values of a university air squadron were quite priceless. "However," he added, "I have been making a few enquiries. The Treasury point of view is quite simple. Over the past ten years it has been costing about £1,300,000 annually to run the squadrons, and out of 78,000 members only 436 have taken permanent commissions in the RAF. But everyone in the Air Ministry—in uniform at least—is very conscious of the value of the squadrons and I am certain my optimism will be justified in the light of future events."

Commanders Confer

AT Air Ministry last week (March 23 and 24) the Chief of the Air Staff, Air Chief Marshal Sir Thomas Pike, held the second of his annual conferences of home and overseas commanders-in-chief. The object of the conference was to discuss broad strategic problems affecting the RAF now and in the next decade, and to consider operational, organizational and personnel problems affecting commands. The CAS intends to hold these conferences in the spring of each year and a similar meeting, for home commanders only, in the autumn.

A Twin Pioneer and two Prestwick Pioneers of the Royal Malayan Air Force, on whose behalf the Government of the Federation of Malaya has placed an order with Scottish Aviation for ten Twin Pioneer Series 3 aircraft. The four existing Twin Pioneers of the RMAF are to be returned for conversion to full Series 3 standard. See also brief "All Quarters" news-item



IN BRIEF

Princess Margaret is to visit RAF Finningley, near Doncaster, Yorks, on Tuesday, June 6.

The RAFA annual conference is being held at Douglas, Isle of Man, on June 3 and 4.

The boxer mascot of No 6 Sqn at RAF Akrotiri in Cyprus, "Flt Lt" Rusty, died recently "after 15 years' distinguished service" and was accorded full military honours.

Main RAF feature at this year's Royal Tournament (May 31-June 17, Earls Court, London) will be Operation Mayday, a simulated ASR/mountain rescue operation.

The annual dinner of the Pathfinder Association and Club is being held on Monday, May 8, at the Dorchester Hotel, London. Details are available from the Secretary, 118 Mount Street, W1.

The sixteenth annual reunion of the Headquarters Bomber Command Association of Officers is being held at HQ Bomber Command, RAF High Wycombe, Bucks, on Saturday, May 27. Any members who have not received details of this reunion can obtain them by applying to the honorary secretary of the Association at the above address.

The RAF Benevolent Fund has received a donation of £50 from the RAF Officer Pilots' Tie Club. Membership of the club, which was founded in 1937, is restricted to past and present officer pilots of the RAF, RAuxAF and Dominion Air Forces who have flown at least 500hr as pilot or have taken part in active service flying operations.

Lancaster S for Sugar, which stands by the main gates of RAF Scampton, Lincs, has been "armed" with a Grand Slam and Tallboy bomb. Both these types of weapon were used by No 617 Sqn on operations from Scampton. The aircraft served there with No 83 Sqn for three years from 1942 and carried out a record total of 137 raids.

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In our advertisement of March 16, we inadvertently stated that the Tiger Moth was rebuilt by the College of Aeronautics. It was in fact rebuilt by the College of Aeronautical Engineering, Redhill. We offer our apologies to both parties for any inconvenience which may have arisen. The aircraft is no more or less an excellent buy, at £625.

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DC-3 P. & W. 1830-92. Nil hour engines, airframe and propellers, D.H. Dove 1B. Queen 70/4. Nil hour engines, airframe and propellers. For further details apply: Channel Airways, Southend Airport, Essex. [0468

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D.H. DOVE 1B, nil hour engines, airframe and propellers. £10,500. For further details apply: Channel Airways, Southend Airport, Essex. [1996

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AUSTER V LYCOMING, 4 seater, 3 year C. of A., expires October 1963, full blind panel, 23 Channel Murphy V.H.F.; starter, generator, long range tank, oblique photo windows and vertical camera hatch with drift sight, yellow and red anti-collision paint, £1,800. —Photopia Ltd., Newcastle, Staffs. [2001

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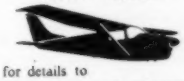

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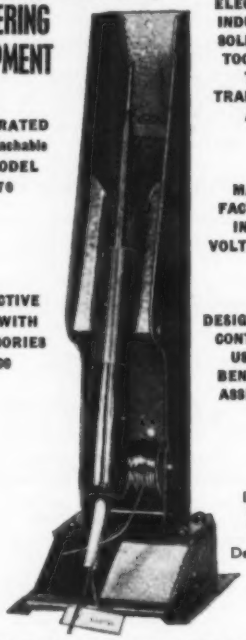

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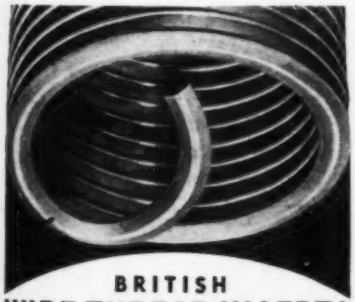

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